

2020 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 8.0

Volume 1: Overview and User Guide

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1 Purpose of the TRM

The purpose of the Illinois Statewide Technical Reference Manual (TRM or IL-TRM) is to provide a transparent and consistent basis for calculating energy (electric kilowatt-hours (kWh) and natural gas therms) and capacity (electric kilowatts (kW)) savings generated by the State of Illinois' energy efficiency programs¹ which are administered by the state's largest electric and gas Utilities² (collectively, Program Administrators or the Utilities).

The TRM is a technical document that is filed with the Illinois Commerce Commission (Commission or ICC) and is intended to fulfill a series of objectives, including:

- "Serve as a common reference document for all... stakeholders, [Program Administrators], and the Commission, so as to provide transparency to all parties regarding savings assumptions and calculations and the underlying sources of those assumptions and calculations.
- Support the calculation of the Illinois Total Resource Cost test³ ("TRC"), as well as other cost-benefit tests in support of program design, evaluation and regulatory compliance. Actual cost-benefit calculations and the calculation of avoided costs will not be part of this TRM.
- Identify gaps in robust, primary data for Illinois, that can be addressed via evaluation efforts and/or other targeted end-use studies.
- [Provide] a process for periodically updating and maintaining records, and preserve a clear record of what deemed parameters are/were in effect at what times to facilitate evaluation and data accuracy reviews.
- ...[S]upport coincident peak capacity (for electric) savings estimates and calculations for electric utilities in a manner consistent with the methodologies employed by the utility's Regional Transmission Organization ("RTO"), as well as those necessary for statewide Illinois tracking of coincident peak capacity impacts."⁴

1.1 Acknowledgments

This document was created through collaboration amongst the members of the Illinois Energy Efficiency Stakeholder Advisory Group (SAG). The SAG is an open forum where interested parties may participate in the evolution of Illinois' energy efficiency programs. Parties wishing to participate in the SAG process may do so by visiting <http://www.ilsag.info/questions.html> and contacting the Independent Facilitator Celia Johnson at celia@celiajohnsonconsulting.com. Parties wishing to participate in the Technical Advisory Committee (TAC), a subcommittee of the SAG, may do so by contacting the TRM Administrator at iltrmadministrator@veic.org.

SAG/TAC Stakeholders ⁵
ADM Associates
Ameren Illinois Company (Ameren)
Apex Analytics
Applied Energy Group
Cadmus
Citizen's Utility Board (CUB)
City of Chicago
CLEAResult
Commonwealth Edison Company (ComEd)
CNT Energy
DNV GL

¹ 220 ILCS 5/8-103B and 220 ILCS 5/8-104.

² The Program Administrators include: Ameren Illinois, ComEd, Peoples Gas, North Shore Gas, and Nicor Gas (collectively, the Utilities).

³ The Illinois TRC test is defined in 220 ILCS 5/8-104(b) and 20 ILCS 3855/1-10.

⁴ Illinois Statewide Technical Reference Manual Request for Proposals, August 22, 2011, pages 3-4, http://ilsag.org/yahoo_site_admin/assets/docs/TRM_RFP_Final_part_1.230214520.pdf

⁵ Being an open forum, this list of SAG stakeholders and participants may change at any time.

SAG/TAC Stakeholders ⁵
Elevate Energy
Energy Resources Center at the University of Illinois, Chicago (ERC)
Environment IL
Environmental Law and Policy Center (ELPC)
First Tracks Consulting Service, Inc.
Franklin Energy
Frontier Energy
Future Energy Enterprises LLC
GDS Associates
GTI Energy
Illinois Attorney General's Office (AG)
Illinois Commerce Commission Staff (ICC Staff)
Itron
Leidos
Metropolitan Mayor's Caucus (MMC)
Michaels Energy
Midwest Energy Efficiency Association (MEEA)
Natural Resources Defense Council (NRDC)
Navigant
Nexant
Nicor Gas
Opinion Dynamics
Peoples Gas and North Shore Gas
Resource Innovations
Slipstream
360 Energy Group

Table 1.1: Document Revision History

Document Title	Applicable to PY Beginning
Illinois_Statewide_TRM_Effective_060112_Version_1.0_091412_Clean.doc	6/1/12
Illinois_Statewide_TRM_Effective_060113_Version_2.0_060713_Clean.docx	6/1/13
Illinois_Statewide_TRM_Effective_060114_Version_3.0_022414_Clean.docx	6/1/14
Illinois_Statewide_TRM_Effective_060115_Final_022415_Clean.docx	6/1/15
IL-TRM_Effective_060116_v5.0_Vol_1_Overview_021116_Final IL-TRM_Effective_060116_v5.0_Vol_2_C_and_I_021116_Final IL-TRM_Effective_060116_v5.0_Vol_3_Res_021116_Final IL-TRM_Effective_060116_v5.0_Vol_4_X-Cutting_Measures_and_Attach_021116_Final	6/1/16
IL-TRM_Effective_010118_v6.0_Vol_1_Overview_020817_Final IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final IL-TRM_Effective_010118_v6.0_Vol_3_Res_020817_Final IL-TRM_Effective_010118_v6.0_Vol_4_X-Cutting_Measures_and_Attach_020817_Final	1/1/18
IL-TRM_Effective_010119_v7.0_Vol_1_Overview_092818_Final IL-TRM_Effective_010119_v7.0_Vol_2_C_and_I_092818_Final IL-TRM_Effective_010119_v7.0_Vol_3_Res_092818_Final IL-TRM_Effective_010119_v7.0_Vol_4_X-Cutting_Measures_and_Attach_092818_Final	1/1/19
IL-TRM_Effective_010120_v8.0_Vol_1_Overview_101719_Final IL-TRM_Effective_010120_v8.0_Vol_2_C_and_I_101719_Final IL-TRM_Effective_010120_v8.0_Vol_3_Res_101719_Final	1/1/20

Document Title	Applicable to PY Beginning
IL-TRM_Effective_010120_v8.0_Vol_4_X-Cutting_Measures_and_Attach_101719_Final	

1.2 Summary of Measure Revisions

The following tables summarize the evolution of measures that are new, revised or errata. This version of the TRM contains 136 measure-level changes as described in the following table.

Table 1.2: Summary of Measure Level Changes

Change Type	# Changes
Errata	23
Revision	79
New Measure	23
Retired	11
Total Changes	136

The 'Change Type' column indicates what kind of change each measure has gone through. Specifically, when a measure error was identified and the TAC process resulted in a consensus, the measure is identified here as an 'Errata'. In these instances the measure code indicates that a new version of the measure has been published, and that the effective date of the measure dates back to January 1st, 2019. Measures that are identified as 'Revised' were included in the sixth edition of the TRM, and have been updated for this edition of the TRM. Both 'Revised' and 'New Measure(s)' have an effective date of January 1st, 2020.

The following table provides an overview of the 136 measure-level changes that are included in this version of the TRM.

Table 1.3: Summary of Measure Revisions

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
Volume 1: Overview	N/A	N/A	N/A	Revision	Edits to 2.4 Program Delivery & Baseline Definitions. New section 2.4.1 Default Measure Type for Program Delivery Methods. New section 3.4 Provisional Measures Savings Assumptions. Updates to Loadshapes: R01, R02, R03, R04, R05, R13, R14, R17, R18 New loadshapes: C56, C57, C58 Edits to 3.3.1 LED Lamp and Linear Fluorescents Baseline treatment, including specific additional assumptions for Income Eligible programs; agreement to participate in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made for standard and Income Eligible programs; and schedule for potential application of any such agreed upon adjustments. Edits to 3.9 Measure Incremental Cost Definition, and 3.10 Discount Rates, Inflation Rates and O&M Costs.	N/A
Volume 2: C&I	4,1 Agricultural	4.1.4 Livestock Waterer	CI-AGE-LSW1-V03-190101	Errata	Removal of summer peak demand savings as savings occur in the winter.	Decrease demand
		4.1.5 Fan Thermostat Controller	CI-AGE-FNTC-V01-200101	New	New measure	N/A
		4.1.6 Low Pressure Sprinkler Nozzles	CI-AGE-LPSN-V01-200101	New	New measure	N/A
		4.1.7 Milk Pre-Cooler	CI-AGE-MLKP-V01-200101	New	New measure	N/A
		4.1.8 VSD Milk Pump with Plate Cooler Heat Exchanger	CI-AGE-VSDM-V01-200101	New	New measure	N/A
		4.1.9 Scroll Compressor for Dairy Refrigeration	CI-AGE-SCRC-V01-200101	New	New measure	N/A
		4.1.10 Dairy Refrigeration Heat Recovery	CI-AGE-DRHR-V01-200101	New	New measure	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
		4.1.11 Commercial LED Grow Lights	CI-AGE-GROW-V01-200101	New	New measure	N/A
	4.2 Food Service Equipment	4.2.6 ENERGY STAR Dishwasher	CI-FSE-ESDW-V05-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
		4.2.8 ENERGY STAR Griddle	CI-FSE-ESGR-V04-200101	Revision	Added assumptions for double-sided griddles.	N/A
		4.2.10 Ice Maker	CI-FSE-ESIM-V03-200101	Revision	Addition of CEE Tier 2 Advanced criteria. Removal of exclusion for flake and nugget machines.	N/A
		4.2.11 High Efficiency Pre-Rinse Spray Valve	CI-FSE-SPRY-V06-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			CI-FSE-SPRY-V07-200101	Revision	Update to federal standard. Updated flow rate for DI programs. Updated measure costs. Added KITS.	Decrease
		4.2.20 Efficient Dipper Wells	CI-FSE-EDIP-V01-200101	New	New measure	N/A
	4.3 Hot Water	4.3.1 Water Heater	CI-HWE-STWH-V04-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			CI-HWE-STWH-V05-200101	Revision	Combined this measure with 4.3.5 Tankless Water Heater. Clarifications of TOS, NC and unit types.	N/A
		4.3.2 Low Flow Faucet Aerators	CI-HWE-LFFA-V09-190101	Errata	Changes to secondary water savings for Cook county participants. Added KITS.	Decrease for select participants
		4.3.3 Low Flow Showerheads	CI-HWE-LFSH-V06-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			CI-HWE-LFSH-V07-200101	Revision	Updated shower temperature with newer source.	Decreases
		4.3.4 Commercial Pool Covers	CI-HWE-PLCV-V03-200101	Revision	Addition of loadshape and example calculation	N/A
		4.3.5 Tankless Water Heater	N/A	Retired	Measure retired and merged with 4.3.1 Water Heater	N/A
		4.3.6 Ozone Laundry	CI-HWE-OZLD-V03-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			CI-HWE-OZLD-V04-200101	Revision	Addition of assumptions for laundromats	N/A
		4.3.7 Multifamily Central Domestic Hot	CI-HWE-MDHW-V04-200101	Revision	Update to timing of IECC 2018.	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
		Water Plants				
		4.3.9 Heat Recovery Grease Trap Filter	CI-HWE-GRTF-V02-200601	Revision	Clarification of program types and baselines	N/A
		4.3.11 Tunnel Washers	CI-HWE-TUWA-V01-200101	New	New measure	N/A
	4.4 HVAC	4.4 HVAC End Use	N/A	Revision	Update to select building type heating and cooling EFLH assumptions that have been transitioned and calibrated to OpenStudio by the Modeling Subcommittee. Addition of New Construction EFLH assumptions. Addition of three building types – Auto dealership, Drug Store, Public Sector.	Dependent on inputs
		4.4.6 Electric Chiller	CI-HVC-CHIL-V07-200101	Revision	Update to timing of IECC 2018. Update to measure cost.	N/A
		4.4.9 Air and Water Source Heat Pump Systems	CI-HVC-HPSY-V07-200101	Revision	Update to timing of IECC 2018.	N/A
		4.4.10 High Efficiency Boiler	CI-HVC-BOIL-V07-200101	Revision	Update to measure life. Addition of NC as program type.	N/A
		4.4.11 High Efficiency Furnace	CI-HVC-FRNC-V09-200101	Revision	Update to Cooling Run Hour assumptions based on OpenStudio modelling. Addition of NC as program type.	N/A
		4.4.13 Package Terminal Air Conditioner (PTAC) and Package Terminal Heat Pump (PTHP)	CI-HVC-PTAC-V10-200101	Revision	Update to existing efficiency assumption. Correction of example calculation.	Decrease for early replacement
		4.4.15 Single-Package and Split System Unitary Air Conditioners	CI-HVC-SPUA-V07-200101	Revision	Update to timing of IECC 2018.	N/A
		4.4.16 Steam Trap Replacement or Repair	CI-HVC-STRE-V06-200101	Revision	Addition of water impacts. Addition of instruction to use actual orifice diameter wherever possible. Addition of kWh savings from water supply.	Increase
		4.4.17 Variable Speed Drives for HVAC Pumps and Cooling Tower Fans	CI-HVC-VSDHP-V06-190101	Errata	Fixing error in ESF/DSF calculation	Increase for Cooling Tower Fan
			CI-HVC-VSDHP-V07-	Revision	Update to timing of IECC 2018.	Dependent

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
			200101		Updates to Heating and Cooling Run Hour table and ESF/DSF based on new OpenStudio results.	on building type
		4.4.18 Small Commercial Programmable Thermostats	CI-HVC-PROG-V02-200101	Retired	Measure retired and replaced with new measure 4.4.48 Small Commercial Thermostats - Provisional	N/A
		4.4.20 High Turndown Burner for Space Heating Boilers	CI-HVAC-HTBC-V05-200601	Revision	Addition of code requirements, clarification on measure life and costs.	N/A
		4.4.23 Shut Off Damper for Space Heating Boilers or Furnaces	CI-HVC-SODP-V02-200601	Revision	Clarification on measure life and costs.	N/A
		4.4.25 Small Commercial Programmable Thermostats Adjustments	CI-HVC-PRGA-V03-190101	Retired	Measure retired.	N/A
		4.4.26 Variable Speed Drives for HVAC Supply and Return Fan	CI-HVC-VSDF-V04-190101	Errata	Change measure life consistent with other VSDs	Increase lifetime savings
			CI-HVC-VSDF-V05-200101	Revision	Update to timing of IECC 2018. Update to Fan Run Hour table with OpenStudio results.	Dependent on building type
		4.4.27 Energy Recovery Ventilator	CI-HVC-ERVE-V04-200101	Revision	Update to timing of IECC 2018. Update measure costs.	N/A
		4.4.30 Notched V Belts for HVAC Systems	CI-HVC-NVBE-V05-200101	Revision	Update to Fan Run Hour table with OpenStudio results.	Dependent on building type
		4.4.31 Small Business Furnace Tune-Up	CI-HVC-FTUN-V03-200101	Revision	Measure life updated to 3 years.	Increase lifetime savings
		4.4.32 Combined Heat and Power	CI-HVC-CHAP-V04-200101	Revision	Clarification of Fthermal variable definition.	N/A
		4.4.33 Industrial Air Curtain	CI-HVC-AIRC-V03-200101	Revision	Update to timing of IECC 2018. Clarification of code for New Construction.	N/A
		4.4.34 Destratification Fan	CI-HVC-DSFN-V04-200101	Revision	Clarification of code for New Construction roof R-value assumption.	N/A
		4.4.41 Advanced	CI-HVC-ARTC-V02-200101	Revision	Addition of assumptions for electrically heated	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
		Rooftop Controls			building.	
		4.4.42 Advanced Thermostats for Small Commercial	CI-HVC-ADTH-V02-190101	Retired	Measure retired and replaced with new measure 4.4.48 Small Commercial Thermostats - Provisional	N/A
		4.4.44 Commercial Ground Source and Ground Water Source Heat Pump	CI-HVC-GSHP-V03-200101	Revision	Update to timing of IECC 2018.	N/A
		4.4.45 Adsorbent Air Cleaning	CI-HVC-ADAC-V02-200101	Revision	Restricted to RF applications. Removal of defaults for % reduction of outside air. Removal of gas savings until more data collected.	N/A
		4.4.46 Server Room Temperature Set Back	CI-HVC-SRSB-V01-200101	New	New measure	N/A
		4.4.47 Air Deflectors for Unit Ventilators	CI-HVC-ADUV-V01-200101	New	New measure	N/A
		4.4.48 Small Commercial Thermostats - Provisional	CI-HVC-THST-V01-200101	New	New measure	N/A
	4.5 Lighting	4.5 Lighting End Use	N/A	Revision	Addition of footnote to detail source of refrigerated and freezer case waste heat factors. Additional OpenStudio derived outputs.	N/A
		4.5.1 Commercial Compact Fluorescent Lamp	N/A	Retired	Measure removed	N/A
		4.5.3 High Performance and Reduced Wattage T8 Fixtures and Lamps	CI-LTG-T8FX-V08-190101	Errata	Correction of default midlife adjustment factors. Remaining useful life to the midlife adjustment is calculated based on 1/3 assumed rated hours.	N/A
			CI-LTG-T8FX-V09-200101	Revision	Update to timing of T12 baseline.	Increased lifetime savings
		4.5.4 LED Bulbs and Fixtures	CI-LTG-LEDB-V09-190101	Errata	Applying appropriate TOS and Early Replacement assumptions. For TOS, baseline is 100% T8 and midlife adjustment is removed. For early replacement, remaining useful life to the midlife adjustment is calculated based on 1/3 assumed rated hours.	N/A
			CI-LTG-LEDB-V10-200101	Revision	Text added to explain savings is 0 post-EISA	Decreased

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					backstop, assumed now to be 1/1/2022 for Standard A-lamps and 1/1/2025 for specialties and directional, although Utilities reserve the right to claim additional savings post backstop between Super-Efficient LED and baseline LED. Measure life is limited to number of years to baseline shift. Midlife adjustment removed. O&M calculation redone - now with shorter measure life, adjusted shift timing and including a LED purchase after shift. Agreement to participate in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made; and schedule for potential application of any such agreed upon adjustments.	lifetime savings
		4.5.6 LED Traffic and Pedestrian Signals	CI-LTG-LEDT-V02-200601	Revision	Clarifications to measure life and hour assumptions.	N/A
		4.5.7 Lighting Power Density	CI-LTG-LPDE-V06-200101	Errata	Correcting LPD values to match final IECC 2018 values.	N/A
		4.5.11 Solar Light Tubes	CI-LTG-STUB-V03-200101	Revision	Updated costs.	N/A
		4.5.12 T5 Fixtures and Lamps	CI-LTG-T5FX-V07-190101	Errata	For early replacement, remaining useful life to the midlife adjustment is calculated based on 1/3 assumed rated hours.	Increase lifetime savings
			CI-LTG-T5FX-V08-200101	Revision	Replaced RF term with EREP.	N/A
		4.5.14 Commercial Specialty Compact Fluorescent Lamp	N/A	Retired	Measure removed	N/A
	4.6 Refrigeration	4.6.3 Door Heater Controls for Cooler or Freezer	CI-RFG-DHCT-V03-200101	Revision	Footnote clarifying WHFs	N/A
		4.6.8 Refrigeration Economizers	CI-RFG-ECON-V06-200101	Revision	Addition of code requirements. Update to measure costs.	N/A
		4.6.11 Q-Sync Motors for Reach-in Coolers/Freezers	CI-RFG-QMF-V02-200101	Revision	Added walk-in refrigeration evaporators.	N/A
		4.6.12 Variable Speed Drive for Condenser Fans	CI-RFG-VSC-V02-200101	Revision	Updated cost assumption. Update to savings factors.	Decreases

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
	4.7 Compressed Air	4.7.1 VSD Air Compressor	CI-CPA-VSDA-V03-200101	Revision	Increase size limit. Clarification of baseline as oil-flooded compressor. Addition of unknown hours.	N/A
		4.7.2 Compressed Air Low Pressure Drop Filters	CI-CPA-LPDF-V03-200101	Revision	Clarification, typo fixes	N/A
		4.7.3 Compressed Air No-Loss Condensate Drains	CI-CPA-NCLD-V03-200101	Revision	Updated Incremental Cost	N/A
		4.7.6 Vortex Tube Thermostat	CI-CPA-VTEX-V01-200101	New	New measure	N/A
		4.7.7 Efficient Desiccant Compressed Air Dryer	CI-CPA-DDRY-V01-200101	New	New measure	N/A
	4.8 Miscellaneous	4.8.2 Roof Insulation for C&I Facilities	CI-MSC-RINS-V04-200101	Revision	Update to timing of IECC 2018.	N/A
		4.8.3 Computer Power Management Software	CI-MSC-CPMS-V02-200101	Revision	Major change based on newer data	Decrease
		4.8.6 ENERGY STAR Computers	CI-MSC-COMP-V02-200101	Revision	Updated ENERGY STAR, 80 Plus and Titanium specs.	Increase
		4.8.7 Advanced Power Strip – Tier 1 Commercial	CI-MSC-APSC-V03-200101	Revision	Clarification of reference and costs.	N/A
		4.8.12 Spring-Loaded Garage Door Hinge	CI-MSC-SLDH-V01-200101	New	New measure	N/A
		4.8.13 Variable Speed Drives for Process Fans	CI-MSC-VSDP-V01-200101	New	New measure	N/A
		4.8.14 Low Flow Toilet and Urinals	CI-MSC-LFTU-V01-200101	New	New measure	N/A
		4.8.15 Smart Irrigation Controls	CI-MSC-SIRC-V01-200101	New	New measure	N/A
		4.8.16 Commercial Weather Stripping	CI-MSC-WTST-V01-200101	New	New measure	N/A
Volume 3: Residential	5.1 Appliances	5.1.1 ENERGY STAR Air Purifier	RS-APL-ESAP-V03-200601	Revision	Clarification of Coincidence Factor	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
		5.1.2 ENERGY STAR Clothes Washer	RS-APL-ESCL-V07-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			RS-APL-ESCL-V08-200101	Revision	Update to # cycles assumption and % electric DHW and % electric dryer.	Increase
		5.1.3 ENERGY STAR Dehumidifier	RS-APL-ESDH-V06-190101	Errata	Recalculation of savings.	Dependent on type
			RS-APL-ESDH-V07-200101	Revision	Update to Federal Standard and ENERGY STAR criteria. Measure cost update.	Dependent on type
		5.1.4 ENERGY STAR Dishwasher	RS-APL-ESDI-V05-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
		5.1.6 ENERGY STAR and CEE Tier 2 Refrigerator	RS-APL-ESRE-V07-200101	Revision	Make RUL assumption consistent.	N/A
		5.1.10 ENERGY STAR Clothes Dryer	RS-APL-ESDR-V03-200101	Revision	Addition of loadshape.	N/A
		5.1.12 Ozone Laundry	RS-APL-OZNE-V02-200101	Revision	Addition of multifamily common area assumptions.	N/A
	5.2 Consumer Electronics	5.2.1 Advanced Power Strip – Tier 1	RS-CEL-SSTR-V05-200101	Revision	Addition of community distributed kit ISR and update to school ISR.	N/A
		5.2.2 Advanced Power Strip – Residential Audio Visual	RS-CEL-APS2-V04-200101	Revision	Update to BaselineEnergy assumption. Update to classification memo.	Dependent on type
	5.3 HVAC	5.3.1 Air Source Heat Pump	RS-HVC-ASHP-V09-200101	Revision	Clarification electric resistance deferred replacement cost	N/A
		5.3.4 Duct Insulation and Sealing	RS-HVC-DINS-V08-200101	Revision	Addition of deemed values for system efficiency and %homes with fuel types.	N/A
		5.3.5 Furnace Blower Motor	RS-HVC-FBMT-V05-200101	Revision	Removal of TOS and NC – now a retrofit or early replacement measure. Update to lifetime and cost.	N/A
		5.3.7 Gas High Efficiency Furnace	RS-HVC-GHEF-V09-200101	Revision	Fixing denominator in example calc - 100067 to 100000 as per algorithm	N/A
		5.3.8 Ground Source Heat Pump	RS-HVC-GSHP-V09-200101	Revision	Fixing denominator in example calc - 100067 to 100000 as per algorithm	N/A
		5.3.10 HVAC Tune Up	RS-HVC-TUNE-V05-200101	Revision	Update to measure life	N/A
		5.3.11 Programmable	RS-HVC-PROG-V06-	Revision	Clarification that savings are on household level	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
		Thermostats	200101		and should be claimed for one per home. Update to MF/SF split.	
		5.3.12 Ductless Heat Pumps	RS-HVC-DHP-V07-190101	Errata	Clarification of remaining useful life for electric resistance heat and electric resistance deferred replacement cost	N/A
		5.3.13 Residential Furnace Tune-Up	RS-HVC-FTUN-V05-200101	Revision	Fixing typo in algorithm. Measure life update.	N/A
		5.3.15 ENERGY STAR Ceiling Fan	RS-HVC-CFAN-V03-200101	Revision	Updates to baseline and efficient standards.	Decrease
		5.3.16 Advanced Thermostats	RS-HVC-ADTH-V04-200101	Revision	Clarification that savings are on household level and should be claimed for one per home. Update to MF/SF split.	N/A
		5.3.18 Furnace Filter Alarm	RS-HVC-FUWH-V01-200101	New	New measure	N/A
	5.4 Hot Water	5.4.3 Heat Pump Water Heaters	RS-HWE-HPWH-V08-190101	Errata	Update to baseline algorithm	N/A
			RS-HWE-HPWH-V09-200101	Revision	Update to loadshape. Fixing baseline EF in example calculation.	N/A
		5.4.4 Low Flow Aerators	RS-HWE-LFFA-V08-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			RS-HWE-LFFA-V09-200101	Revision	Addition of community distributed kit ISR and update to school ISR.	Decreases dependent on program
		5.4.5 Low Flow Showerheads	RS-HWE-LFSH-V07-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
			RS-HWE-LFSH-V08-200101	Revision	Update to school and DI ISR.	Decreases dependent on program
		5.4.6 Water Heater Temperature Setback	RS-HWE-TMPS-V07-200101	Revision	Addition of school instructions kit ISRs	N/A
		5.4.8 Thermostat Restrictor Valve	RS-HWE-TRVA-V05-190101	Errata	Changes to secondary water savings for Cook county participants. Change to DI GPM.	Decrease for select participants
		5.4.9 Shower Timer	RS-DHW-SHTM-V03-190101	Errata	Changes to secondary water savings for Cook county participants.	Decrease for select participants
		5.4.10 Pool Covers	RS-HWE-PLCV-V01-	New	New measure	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
			200101			
	5.5 Lighting	5.5.1 Compact Fluorescent Lamp	N/A	Retired	Measure removed	N/A
		5.5.2 Specialty Compact Fluorescent Lamp	N/A	Retired	Measure removed	N/A
		5.5.3 ENERGY STAR Torchiere	N/A	Retired	Measure removed	N/A
		5.5.4 Exterior Hardwired Compact Fluorescent Lamp Fixture	N/A	Retired	Measure removed	N/A
		5.5.5 Interior Hardwired Compact Fluorescent Lamp Fixture	N/A	Retired	Measure removed	N/A
		5.5.6 LED Specialty Lamps	RS-LTG-LEDD-V10-200101	Revision	Update to Res v C&I split, ISR and leakage. Text added to explain savings is 0 post-EISA backstop, now 1/1/2025, although Utilities reserve the right to claim additional savings post backstop between Super-Efficient LED and baseline LED. Measure life is limited to number of years to baseline shift. Midlife adjustment removed. O&M calculation redone - now with shorter measure life, adjusted shift timing and including a LED purchase after shift. Savings are assumed not to go to zero until January 1, 2026 for all Income Eligible programs, except for DIY, Warehouse, and Big Box stores in Income Eligible Upstream Lighting programs. Agreement to participate in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made for standard and Income Eligible programs; and schedule for potential application of any such agreed upon adjustments.	Decrease lifetime savings
		5.5.8 LED Screw Based Omnidirectional Bulbs	RS-LTG-LEDA-V08-200101	Revision	Update to Res v C&I split, ISR and leakage. Text added to explain savings is 0 post-EISA backstop, now 1/1/2022, although Utilities	Decrease lifetime savings

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					reserve the right to claim additional savings post backstop between Super-Efficient LED and baseline LED. Measure life is limited to number of years to baseline shift. Midlife adjustment removed. O&M calculation redone - now with shorter measure life, adjusted shift timing and including a LED purchase after shift. Savings are assumed not to go to zero until January 1, 2026 for all Income Eligible programs, except for DIY, Warehouse, and Big Box stores in Income Eligible Upstream Lighting programs. Agreement to participate in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made for standard and Income Eligible programs; and schedule for potential application of any such agreed upon adjustments.	
		5.5.9 LED Fixtures	RS-LTG-LDFX-V02-200101	Revision	Text added to explain savings is 0 post-EISA backstop, now 1/1/2025, although Utilities reserve the right to claim additional savings post backstop between Super-Efficient LED and baseline LED. Measure life is limited to number of years to baseline shift. Midlife adjustment removed. O&M calculation redone - now with shorter measure life, adjusted shift timing and including a LED purchase after shift. Savings are assumed not to go to zero until January 1, 2026 for all Income Eligible programs, except for DIY, Warehouse, and Big Box stores in Income Eligible Upstream Lighting programs. Agreement to participate in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made for standard and Income Eligible programs; and schedule for potential application of any such agreed upon adjustments.	Decrease lifetime savings
		5.5.10 Holiday String Lighting	RS-LTG-LEDH-V02-200101	Revision	Update to leakage assumption	Decrease
		5.5.12 Connected LED Lamps	RS-LTG-LEDC-V01-200101	New	New measure	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
	5.6 Shell	5.6.1 Airsealing	RS-SHL-AIRS-V08-200101	Revision	Addition of shrink fit window film to Rx section Addition of income eligible adjustment to offset net savings inherent in ADJ variable. Addition of deemed value for system efficiency and %homes.	N/A
		5.6.2 Basement Sidewall Insulation	RS-SHL-BINS-V10-200101	Revision	Addition of deemed value for system efficiency and %homes.	N/A
		5.6.3 Floor Insulation Above Crawlspace	RS-SHL-FINS-V10-190101	Errata	Update to default for uninsulated floor.	Increase
			RS-SHL-FINS-V11-200101	Revision	Addition of deemed value for system efficiency and %homes.	N/A
		5.6.4 Wall Insulation	RS-SHL-WINS-V09-200101	Revision	Addition of deemed value for system efficiency and %homes.	N/A
		5.6.5 Ceiling/Attic Insulation	RS-SHL-AINS-V02-200101	Revision	Addition of income eligible adjustment to offset net savings inherent in ADJ variable. Update to uninsulated R-value assumption. Addition of deemed value for system efficiency and %homes.	Increase
		5.6.6 Rim/Band Joist Insulation	RS-SHL-RINS-V02-200101	Revision	Addition of deemed value for system efficiency and %homes.	N/A
	5.7 Miscellaneous	5.7.2 Low Flow Toilets	RS-MSC-LFTU-V01-200101	New	New Measure	N/A
Volume 4: Cross Cutting Measures and Attachments	Attachment B	Effective Useful Life for Custom Measure Guidelines	N/A	Revision	Addition of Thermostat Optimization EUL assumption. Split C&I and RES measures. Update to Retrocommissioning EUL.	N/A
	Attachment C	Framework for Counting Market Transformation Savings in Illinois	N/A	New	New section	N/A

Table 1.4: Summary of Attachment A: IL-NTG Methods Revisions

IL-TRM Volume	Sectors	Protocol Name	Change Type	Explanation
Vol. 4	All Sectors	Non-Consensus protocol (from policy manual), 1.5	Revision	Added procedure for addressing non-consensus items regarding IL-NTG Methods
Vol. 4	Residential, Commercial and Industrial	No-Program Score Questions	Revision	Updated language of No-Program questions from “exactly the same equipment” to “equipment of the same high level of efficiency”
Vol. 4	Commercial, Industrial and Public Sector Programs	Core Non-Residential Protocol	Revision	Updated language of Core Free Ridership Scoring Algorithm in section 3.1.1.1 Updated language of Program Influence question in section 3.1.1.1.2 to require naming top two ranking program and non-program factors
Vol. 4	Residential and Low Income	Residential and Low Income Programs	Revision	Added table footnote to Table 4-1 regarding Low Income NTG research
Vol. 4	Residential and Low Income	Residential and Low Income Programs	Revision	Added language to section 4.1.1 on how to address respondents’ misperception of the No-Program question as a satisfaction question
Vol. 4	Cross-Sectors	Code Compliance Protocol	Revision	Deleted original Protocol 5.4 Code Compliance
Vol. 4	Cross-Sectors	Midstream Free-Ridership Protocol	Revision	Added new Protocol 5.4 which addresses NTG for midstream programs
Vol. 4	Residential and Low Income	Appendix B	Revision	Add new citations to reference section

1.3 Enabling ICC Policy

This Illinois Statewide Technical Reference Manual (TRM) was developed to comply with the Illinois Commerce Commission (ICC or Commission) Final Orders from the electric and gas Utilities⁶ Energy Efficiency Plan dockets. In the Final Orders, the ICC required the utilities to work with the Illinois Department of Commerce and Economic Opportunity (DCEO) and the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) to develop a statewide TRM. See, e.g., ComEd's Final Order (*Docket No. 10-0570, Final Order*⁷ at 59-60, December 21, 2010); Ameren's Final Order (*Docket No. 10-0568, Order on Rehearing*⁸ at 19, May 24, 2011); Peoples Gas/North Shore Gas' Final Order (*Docket No. 10-0564, Final Order*⁹ at 76, May 24, 2011), and Nicor's Final Order (*Docket No. 10-0562, Final Order*¹⁰ at 30, May 24, 2011).

As directed in the Utilities' Efficiency Plan Orders, the SAG had the opportunity to, and also participated in, every aspect of the development of the TRM. Interested members of the SAG participated in weekly teleconferences to review, comment, and participate in the development of the TRM. The active participants in the TRM were designated as the "Technical Advisory Committee" (TAC). The TAC participants include representatives from the following organizations:

- the Utilities (ComEd, Ameren IL, Nicor Gas, Peoples Gas/North Shore Gas),
- Implementation contractors (CLEAResult, Conservation Services Group, Elevate Energy, Franklin Energy, GDS Associates, PECL, 360 Energy Group),
- Illinois Department of Commerce and Economic Opportunity (DCEO),
- the independent evaluators (ADM Associates, The Cadmus Group, Itron, Navigant Consulting, Michael's Engineering, Opinion Dynamics Corporation),
- ICC Staff,
- the Illinois Attorney General's Office (AG),
- Natural Resources Defense Council (NRDC),
- the Environmental Law and Policy Center (ELPC),
- the Citizen's Utility Board (CUB),
- The University of Illinois at Chicago,
- Future Energy Enterprises,
- Issue-specific invited participants including; Geothermal Alliance of Illinois, the Geothermal Exchange Organization, Embertec, TrickleStar, Google Nest, Ecobee, and US EPA ENERGY STAR.

1.4 Development Process

Each version of the IL-TRM is approved by the Commission in the ICC Dockets listed below, and can all be found on the ICC webpage; <https://www.icc.illinois.gov/programs/illinois-statewide-technical-reference-manual-for-energy-efficiency>. Errata to the IL-TRM versions may also be found on that ICC IL-TRM webpage.

TRM Version	ICC Docket Number
Version 1.0	12-0528
Version 2.0	13-0437

⁶ The Illinois Utilities subject to this TRM include: Ameren Illinois Company d/b/a Ameren Illinois (Ameren), Commonwealth Edison Company (ComEd), The Peoples Gas Light and Coke Company and North Shore Gas Company, and Northern Illinois Gas Company d/b/a Nicor Gas.

⁷ <http://www.icc.illinois.gov/docket/files.aspx?no=10-0570&docId=159809>

⁸ <http://www.icc.illinois.gov/docket/files.aspx?no=10-0568&docId=167031>

⁹ <http://www.icc.illinois.gov/docket/files.aspx?no=10-0564&docId=167023>

¹⁰ <http://www.icc.illinois.gov/docket/files.aspx?no=10-0562&docId=167027>

TRM Version	ICC Docket Number
Version 3.0	14-0189
Version 4.0	15-0187
Version 5.0	16-0171
Version 6.0	17-0106
Version 7.0	18-1605

The policies surrounding the applicability and use of the IL-TRM in planning, implementation, and evaluation were originally established by the Commission in ICC Docket No. 13-0077¹¹, and most recently in ICC Docket No. 17-0270¹².

This document represents the eighth version of the IL-TRM and it applies to Section 8-103B and Section 8-104 energy efficiency programs. It contains a series of new measures, as well as a series of errata items¹³ and updates to existing measures that were already present in the first seven versions. Like the previous versions, it is a result of an ongoing review process involving the Illinois Commerce Commission (ICC) Staff (Staff or ICC Staff), the Utilities, the Evaluators, the SAG TAC, and the SAG. VEIC meets with the SAG and/or the TRM TAC at least once each month to create a high level of transparency and vetting in the development of this TRM.

Measure requests that are submitted by interested parties are ranked based on the following criteria to determine the approximate priority level for order of inclusion in the TRM:

1. High Priority
 - a. For those existing measures that make up a significant portion of a utilities' portfolio and/or where the impact of the requested change is high
 - b. For new measures where plans are in place to implement in the next program year
2. Medium Priority
 - a. For existing measures that are a less significant percent of a utilities' portfolio and value change will not have a significant impact
 - b. For new measures where a savings value is estimated but implementation plans not yet developed
3. Low Priority
 - a. For existing measures that represent a very small percent of a utilities' portfolio
 - b. For new measures that are just beginning to be explored and will not be implemented in the next program year

These rankings are used to align budget and schedule constraints with desired updates from the TRM.

As measure requests are finalized leading up to the next update of the TRM, weekly TAC meetings are often scheduled to maximize the level of collaboration and visibility into the measure characterization process. Where consensus does not emerge on specific measures or issues, those items are identified in a memo. As a result, this TRM represents a broad consensus amongst the SAG and TAC participants. In keeping with the goal of transparency, all of the comments and their status to-date are available through the TAC SharePoint web site, <https://portal.veic.org>.

For each measure characterization, this TRM includes engineering algorithm(s) and a value(s) for each parameter in the equation(s). These parameters have values that fall into one of three categories: a single deemed value, a lookup

¹¹<http://www.icc.illinois.gov/docket/files.aspx?no=13-0077&docId=203903>;
<http://www.icc.illinois.gov/docket/files.aspx?no=13-0077&docId=195913>;
<http://www.icc.illinois.gov/downloads/public/edocket/339744.pdf>

¹² <https://www.icc.illinois.gov/docket/files.aspx?no=17-0270&docId=257523> Please see IL-TRM Policy Document Version 2.0 available at <https://www.icc.illinois.gov/downloads/public/edocket/447989.pdf>

¹³ Errata as well as links to the official IL-TRM documents, dockets, and policy documents are available on the following ICC webpage: <http://www.icc.illinois.gov/Electricity/programs/TRM.aspx>

table of deemed values or an actual value such as the capacity of the equipment. The TRM makes extensive use of lookup tables because they allow for an appropriate level of measure streamlining and customization within the context of an otherwise prescriptive measure.

Accuracy is the overarching principle that governs what value to use for each parameter. When it is explicitly allowed within the text of the measure characterization, the preferred value is the actual or on-site value for the individual measure being implemented. The *deemed values*¹⁴ in the lookup tables are the next most accurate choice, and in the absence of either an actual value or an appropriate value in a lookup table, the single, *deemed value* should be used. As a result, this single, *deemed value* can be thought of as a default value for that particular input to the algorithm.

A single *deemed savings estimate* is produced by any given combination of an algorithm and the allowable input values for each of its parameters. In cases where lookup tables are provided, there is a range of deemed savings estimates that are possible, depending on site-specific factors such as equipment capacity, location and building type.

Algorithms and their parameter values are included for calculating estimated:

- Gross annual electric energy savings (kWh)
- Gross annual natural gas energy savings (therms)
- Gross electric summer coincident peak demand savings (kW)

To support cost-effectiveness calculations, parameter values are also included for:

- Incremental costs (\$)
- Measure life (years)
- Operation and maintenance costs (\$)
- Water (gal) and other resource savings where appropriate.

1.4.1 Reliability Review

The process of incorporating new and better information into the TRM occurs annually as new measures and errors are identified, program designs change, old measures are dropped from programs, or other external events (such as code and standard changes or new evaluations and other data) warrant a review of assumptions. However, not all measures have updates triggered by such events, and some measures continue to appear in the TRM without ongoing review. Short of proactively identified issues that would trigger an update to a TRM characterization, a regular reliability review should be undertaken to assess that the information in older measures is still relevant and reliable. This review will include a general appraisal of reasonableness and continued program relevancy and an update of any assumptions to reflect new information.

To ensure that measures initially developed in the past and not recently revisited are updated and retired as needed, each measure is given a Review Deadline – a date that triggers a reliability review. This Review Deadline is established for each measure based on factors such as expected revisions to energy codes or federal standards; knowledge of upcoming evaluation or research efforts; knowledge of rapidly changing technology, cost, baselines, or other factors; or expected shifts in current customer practices. No Review Deadline is longer than six years from the date of the initial characterization or last update of a measure. The TRM Administrator will propose Review Deadlines for each measure, and they are reviewed and approved by the TAC. The Review Deadline for each measure is indicated in the measure characterization within the TRM. For example, a Review Deadline specified as 1/1/2019 means that the measure will be reviewed no later than the annual IL-TRM update process that occurs in 2018, in advance of the 1/1/2019 Review Deadline. Following a review and/or update, a new Review Deadline will be assigned to that measure.

¹⁴ Emphasis has been added to denote the difference between a “deemed value” and a “deemed savings estimate”. A deemed value refers to a single input value to an algorithm, while a deemed savings estimate is the result of calculating the end result of all of the values in the savings algorithm.

2 Organizational Structure

The organization of this document follows a three-level format. These levels are designed to define and clarify what the measure is and where it is applied.

1. Market Sectors Volumes¹⁵

- This level of organization specifies the type of customer the measures apply to, either Commercial and Industrial (provided in Volume 2), Residential (provided in Volume 3), or cross-cutting measures, such as Behavior Persistence (provided in Volume 4, together with Attachments including the documentation of Illinois Statewide Net-to-Gross Methodologies, Guidelines for EULs for Custom Measures, and Framework for Counting Market Transformation Savings in Illinois).
- Answers the question, “What category best describes the customer?”

2. End-use Category

- This level of organization represents most of the major end-use categories for which an efficient alternative exists. The following table lists all of the end-use categories in this version of the TRM.
- Answers the question, “To what end-use category does the measure apply?”

Table 2.1: End-Use Categories in the TRM¹⁶

Volume 2: Commercial and Industrial Market Sector	Volume 3: Residential Market Sector	Volume 4: Cross-Cutting Measures and Attachments
Agricultural Equipment	Appliances	Behavior
Food Service Equipment	Consumer Electronics	
Hot Water	Hot Water	
HVAC	HVAC	
Lighting	Lighting	
Refrigeration	Shell	
Compressed Air	Miscellaneous	
Miscellaneous		

3. Measure & Technology

- This level of organization represents individual efficient measures such as CFL lighting and LED lighting, both of which are individual technologies within the Lighting end-use category.
- Answers the question, “What technology defines the measure?”

This organizational structure is silent on which fuel the measure is designed to save; electricity or natural gas. By organizing the TRM this way, measures that save on both fuels do not need to be repeated. As a result, the TRM will be easier to use and to maintain.

2.1 Measure Code Specification

In order to uniquely identify each measure in the TRM, abbreviations for the major organizational elements of the TRM have been established. When these abbreviations are combined and delimited by a dash ('-') a unique, 18-character alphanumeric code is formed that can be used for tracking the measures and their associated savings estimates. Measure codes appear at the end of each measure and are structured using five parts.

¹⁵ Note that the Public sector buildings and low income measures are not listed as a separate Market Sector. The Public building type is one of a series of building types that are included in the appropriate measures in the Commercial and Industrial Sector.

¹⁶ Please note that this is not an exhaustive list of end-uses and that others may be included in future versions of the TRM.

Code Structure = Market + End-use Category + Measure + Version # + Effective Date

For example, the commercial boiler measure is coded: “CI-HVC-BLR_-V01-120601”

Table 2.2: Measure Code Specification Key

Market (@@)	End-use (@@@)	Measure (@@@@)	Version (V##)	Effective Date
CI (C&I)	AGE (Agricultural Equipment)	BLR_	V01	YYMMDD
RS (Residential)	APL (Appliances)	T5FX	V02	YYMMDD
CC (Cross-Cutting)	BEH (Behavior)	T8FX	V03	YYMMDD
	CEL (Consumer Electronics)
	CPA (Compressed Air)			
	FSE (Food Service Equipment)			
	HVC (HVAC)			
	HWE (Hot Water)			
	LTG (Lighting)			
	MSC (Miscellaneous)			
	RFG (Refrigeration)			
	SHL (Shell)			

2.2 Components of TRM Measure Characterizations

Each measure characterization uses a standardized format that includes at least the following components. Measures that have a higher level of complexity may have additional components, but also follow the same format, flow and function.

DESCRIPTION

Brief description of measure stating how it saves energy, the markets it serves and any limitations to its applicability.

DEFINITION OF EFFICIENT EQUIPMENT

Clear definition of the criteria for the efficient equipment used to determine delta savings. Including any standards or ratings if appropriate.

DEFINITION OF BASELINE EQUIPMENT

Clear definition of the efficiency level of the baseline equipment used to determine delta savings including any standards or ratings if appropriate. If a Time of Sale measure the baseline will be new base level equipment (to replace existing equipment at the end of its useful life or for a new building). For Early Replacement or Early Retirement measures the baseline is the existing working piece of equipment that is being removed.

DEEMED LIFETIME OF EFFICIENT EQUIPMENT

The expected duration in years (or hours) of the savings. This is often based on the rated engineering life of the equipment involved, but may also be adjusted based on the expected *Persistence* of the savings. Persistence represents the fraction of first year gross measure savings obtained throughout the measure life. For measures where equipment may be removed, made inoperative, overridden, reduced in effectiveness and/or be poorly maintained, applying a persistence factor to adjust the measure life may be necessary.

If an early replacement measure, the assumed life of the existing unit is also provided.

DEEMED MEASURE COST

For time of sale measures, incremental cost from baseline to efficient is provided. Installation costs should only be included if there is a difference between each efficiency level. For Early Replacement the full equipment and install

cost of the efficient installation is provided in addition to the full deferred hypothetical baseline replacement cost. See '3.9 Measure Incremental Cost Definition' for more detailed information concerning incremental cost calculations.

LOADSHAPE

The appropriate loadshape to apply to electric savings is provided.

COINCIDENCE FACTOR

The summer coincidence factor is provided to estimate the impact of the measure on the utility's system peak – defined as 1PM to hour ending 5PM on non-holiday weekdays, June through August.

Algorithm

CALCULATION OF ENERGY SAVINGS

Algorithms are provided followed by list of assumptions with their definition.

If there are no Input Variables, there will be a finite number of Output values. These will be identified and listed in a table. Where there are custom inputs, an example calculation is often provided to illustrate the algorithm and provide context.

ELECTRIC ENERGY SAVINGS

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NATURAL GAS SAVINGS

WATER IMPACT DESCRIPTIONS AND CALCULATION

DEEMED O&M COST ADJUSTMENT CALCULATION

Only required if the operation and maintenance cost for the efficient case is different to the baseline. See '3.9 Measure Incremental Cost Definition' for information on the appropriate treatment of O&M costs.

MEASURE CODE

REVIEW DEADLINE

If not otherwise updated as part of an identified new TRM issue request before this Review Deadline, the measure will undergo a reliability review for reasonableness, continued program relevancy, and update of material assumptions during the update cycle prior to this deadline.

2.3 Variable Input Tables

Many of the measures in this TRM require the user to select the appropriate input value from a list of inputs for a given parameter in the savings algorithm. Where the TRM asks the user to select the input, look-up tables of allowable values are provided. For example, a set of input parameters may depend on building type; while a range of values may be given for each parameter, only one value is appropriate for any specific building type. If no table of alternative inputs is provided for a particular parameter, then the single deemed value will be used, unless the measure has a custom allowable input.

2.3.1 C&I Custom Value Use in Measure Implementation

This section defines the requirements for capturing Custom variables that can be used in place of defaults for select assumptions within the prescriptive measures defined in this statewide TRM. This approach is to be used when a

variable in a measure formula can be replaced by a verifiable and documented value that is not presented in the TRM. This approach assumes that the algorithms presented in the measure are used as stated and only allows changes to certain variable values and is not a replacement algorithm for the measure. A custom variable is when customer input is provided to define the number or the value is measured at the site. Custom values can also be supplied from product data of the measure installed. In certain cases the custom data can be provided from a documented study or report that is applicable to the measure. Custom variables and potential sources are clearly defined in the specific measures where “Actual” or “Custom” is noted.

In exceptional cases where the participant, program administrator, and independent evaluator all agree that the TRM algorithm for a particular energy efficiency measure does not accurately characterize the energy efficiency measure within a project due to the complexity in the design and configuration of the particular energy efficiency project, a more comprehensive custom engineering and financial analysis may be used that more accurately incorporates the attributes of the measure in the complex energy efficiency project. In such cases and consistent with Commission policy adopted in ICC Docket No. 17-0270, Program Administrators are subject to retrospective evaluation risk (retroactive adjustments to savings based on ex post evaluation findings) for such projects using customized savings calculations.

2.4 Program Delivery & Baseline Definitions

The measure characterizations in this TRM are not grouped by program delivery type. As a result, the measure characterizations provided include information and assumptions to support savings calculations for the range of program delivery options commonly used for the measure. The organizational significance of this approach is that multiple baselines, incremental costs, O&M costs, measure lives and in-service rates are included in the measure characterization(s) that are delivered under two or more different program designs. Values appropriate for each given program delivery type are clearly specified in the algorithms or in look-up tables within the characterization.

Care has been taken to clearly define in the measure’s description the types of program delivery that the measure characterization is designed to support. However, there are no universally accepted definitions for a particular program type, and the description of the program type(s) may differ by measure. Nevertheless, program delivery types can be generally defined according to the following baseline definitions. These are the definitions used in the measure descriptions, and, when necessary, individual measure descriptions may further refine and clarify these definitions of program delivery type.

Baseline Definitions

The energy savings for an efficiency measure is derived, in significant part, by estimating the difference between baseline efficiency and the efficiency of the measure in question. Baselines are the standard practices regarding investment in efficiency (whether measures or operations) that efficiency programs are designed to change. They address the first (gross savings) component of the question “what would have occurred absent the efficiency program?” The answer to that question is completed when making net-to-gross adjustments.

Specific measure baselines are to be covered in the TRM; however, general descriptions and guidance regarding baselines are included here.

Baselines for calculating gross savings can differ depending on the type of efficiency initiative:¹⁷

- **Time of Sale (TOS)**

This type of initiative is designed to influence the decision of a customer who is going to purchase a new product independent of an efficiency program, with the program only influencing the *efficiency level* of the product purchased (not whether a product would be purchased). In most cases, the baseline for time of sale initiatives is the least efficient product the customer is permitted to purchase by law (i.e. complies with state and federal product efficiency standards). However, when there is no equipment available at those legal minimums the baseline shall be adjusted to the TAC agreed efficiency that represents the least

¹⁷ Note that best efforts should be made to ensure that net-to-gross adjustments shall be estimated relative to the specific gross savings baselines for a given product or program.

efficient products that would be commonly purchased in the Illinois market absent efficiency programs. For products for which there are no legal minimum efficiency requirements, the baseline should be the TAC agreed efficiency that represents the least efficient products that would be commonly purchased in the Illinois market absent efficiency programs.

- **New Construction (NC)**

This type of initiative is designed to influence the design and construction of new buildings and major renovations to existing buildings, including decisions regarding which products will be installed in such buildings. Note that it only covers cases in which the independent evaluator concludes that the customer was planning the new construction or major renovation project independent of an efficiency program; cases in which an efficiency program was what triggered a customer to renovate an existing building are treated under the Retrofit or Early Replacement program discussions below. The default baseline for new construction initiatives shall be the applicable efficiency codes (including state or local building codes) and/or product efficiency standards in effect at the time a permit was issued. However, if and when the TAC accepts an assessment of baseline construction practices documenting typical construction practice different than code, whether lower or higher, the results of such study will become the baseline for estimating new construction project savings¹⁸. A baseline that is lower than code can be estimated and used only when the TAC accepts study results demonstrating that the typical industry practice in some geographic regions or market segments is for construction or renovation at a level of efficiency below code.¹⁹

- **Early Replacement (EREP)**

This type of initiative is designed to convince customers to replace functional equipment earlier than they otherwise would. In such cases there shall be a dual baseline, with the existing equipment efficiency (i.e., the efficiency of the equipment being replaced) being the baseline for the remaining useful life of the equipment and a potentially different (typically higher) efficiency for standard *new* products (consistent with the time of sale baselines, as adjusted for any known changes to future codes or standards) being used as baseline for the remaining life of the efficiency measure. Note that for a measure to be treated as “early replacement” each of the following conditions must be met:

- 1) the existing equipment being replaced early must be in good functioning condition or require minimal repair (i.e., it is reasonable to conclude that it would have continued to be used in the absence of the program)
- 2) the independent evaluator must conclude that the program caused the customer to replace their existing equipment before the end of its useful life.

Additional requirements may be developed by the TAC and applied to certain measures to ensure appropriate use of early replacement assumptions, such as a maximum existing unit age, and/or to help ensure a positive cost effectiveness result is achieved, such as requiring maximum existing unit efficiency eligible for early replacement.

- **Early Retirement (ERET)**

This type of initiative is designed to convince customers to remove (and not replace) equipment that would otherwise continue to remain functional (and consume energy). In such cases, the baseline is the existing efficiency of the equipment being removed. Note that for a measure to be treated as “early retirement”,

¹⁸ Baseline efficiency levels set above (i.e., more efficient) than a code/standard baseline are only possible for measures or measure bundles with efficiency alternatives that fall between the relevant code/standard and the efficiency requirement of the program (i.e., an “intermediate efficiency” level), and are only possible in cases where the independent evaluator determines that NTG is not capturing the impact of these intermediate efficiency levels.

¹⁹ This would include cases in which utility programs endeavor to improve code compliance and can measure such improvement. It would also include situations in which a compelling case could be made that a utility initiative was necessary to enable a more efficient state or local code to be adopted (at least sooner than it otherwise would have been).

the existing equipment being removed must be in good functioning condition.

- **Retrofit (RF)**

This type of initiative is designed to convince customers to add efficiency features and/or practices to energy consuming products, systems or buildings. For such measures, the baseline is the existing level of efficiency of the products, systems or buildings to which efficiency features are being added. This is the case even if the act of adding efficiency features and/or practices triggers application of a state or local code because such a trigger would not have occurred absent the efficiency program.

Other Program Delivery Types

Additional program delivery types may have their own distinct assumptions (e.g. In Service Rates) provided within a measure characterization, for example:

- **Direct Install (DI)** - A program where measures are installed by a program representative during a site visit.
- **Efficiency Kits (KITS)** - A program where measures are provided to customers and in an Efficiency Kit and may be distributed through a number of channels (e.g. online ordering, schools, community events, trade shows, etc.).

2.4.1 Default Measure Type for Program Delivery Methods

The decision as to whether a measure is a Time of Sale or Early Replacement measure is critical to ensure the appropriate baseline is used to calculate the measure savings and the appropriate costs are applied. This decision could include consideration of:

- The functionality of or required repair cost of the existing equipment
- The age of the existing equipment and it's estimated remaining useful life
- The role of the Program Administrator or a representative / contractor (referred herein as PA) in the decision to replace the equipment
- The importance of the incentive and/or contact with the PA in the decision to replace the equipment
- The timing of replacement in relation to regular maintenance or recapitalization upgrade schedules

The default position for measures in some common program designs are provided below, however diverging from this default is possible.

Program Type	Default Measure Type
Direct Install	Early Replacement
Audits	Early Replacement if results in replacing functioning equipment
Standard Rx Lighting Program (one to one fixture replacement)	Time of Sale
Standard Rx Lighting Program (lighting system redesign or delamping)	Early Replacement or Early Retirement
Other Standard Rx Programs	Time of Sale or Retrofit
Downstream	Time of Sale
Midstream	Time of Sale
Upstream	Time of Sale

Diverging from the default could be based upon either:

- A unit by unit site specific basis as governed by guidance established by the TAC and clearly documented in

the TRM, for example Residential HVAC early replacement measures require verifying the unit is functional or that required repairs cost less than 20% of the cost of a new baseline unit.

- A TAC agreed divergence could be established on a program/measure level supported by an independent evaluation to demonstrate that the presence of the incentive and/or contact with the Program (for example via targeted marketing material), was significant enough to result in the participants replacing functioning equipment that they would not otherwise have done.

It may be appropriate to apply a deemed percent split of Time of Sale and Early Replacement assumptions based on these evaluation results, noting that it may be observed that different markets or participant groups have very different deemed percentages of early replacements (e.g., low income populations are less likely to replace functioning units early without program involvement).

It is also possible that a project within a property may include both Early Replacement *and* Time of Sale measures. Classification of part of a project as Early Replacement, as defined above, does not preclude classification of another portion of the project as Time of Sale and vice versa.

3 Assumptions

The information contained in this TRM contains VEIC's recommendations for the content of the Illinois TRM. Sources that are cited within the TRM have been chosen based on two priorities, geography and age. Whenever possible and appropriate, VEIC has incorporated Illinois-specific information into each measure characterization. The Business TRM documents from Ameren and ComEd were reviewed, as well as program and measure specific data from evaluations, efficiency plans, and working documents.

The assumptions for these characterizations rest on our understanding of the information available. In each case, the available Illinois and Midwest-specific information was reviewed, including evaluations and support material provided by the Illinois Utilities.

When Illinois or region-specific evaluations or data were not available, best practice research and data from other jurisdictions were used, often from west- and east-coast states that have allocated large amounts of funding to evaluation work and to refining their measure characterization parameters. As a result, much of the most-defensible information originates from these regions. In every case, VEIC used the most-recent, well-designed, and best-supported studies and only if it was appropriate to generalize their conclusions to the Illinois programs.

3.1 Footnotes & Documentation of Sources

Each new and updated measure characterization is supported by a work paper, which is posted to the SharePoint web site (<https://portal.veic.org>).²⁰ Both the work paper and the measure characterizations themselves use footnotes to document the references that have been used to characterize the technology. The reference documents are too numerous to include in an Appendix and have instead been posted to the TRM's SharePoint website. These files can be found in the 'Sources and Reference Documents' folder in the main directory, and are also posted to the SAG's public web site (<http://www.ilsag.info/technical-reference-manual.html>).

3.2 General Savings Assumptions

The TRM savings estimates are expected to serve as average, representative values, or ways to calculate savings based on program-specific information. All information is presented on a per-measure basis. In using the measure-specific information in the TRM, it is helpful to keep the following notes in mind.

- All estimates of energy (kWh or therms) and peak (kW) savings are for first-year savings, not lifetime savings.
- Unless otherwise noted, measure life is defined to be the life of an energy consuming measure, including its equipment life and measure persistence.
- Where deemed values for savings are provided, they represent the average energy (kWh or therms) or peak (kW) savings that could be expected from the average of all measures that might be installed in Illinois in the program year.
- In general, the baselines included in the TRM are intended to represent average conditions in Illinois. Some are based on data from the state, such as household consumption characteristics provided by the Energy Information Administration. Some are extrapolated from other areas, when Illinois data are not available.

3.3 Shifting Baseline Assumptions

The TRM anticipates the effects of changes in efficiency codes and standards on affected measures. When these changes take effect, a shift in the baseline is usually required. This complicates the measure savings estimation somewhat, and will be handled in future versions of the TRM by describing the choice of and reasoning behind a shifting baseline assumption. In this version of the TRM, this applies to CFLs and T5/T8 Linear Fluorescents, Furnaces and Early Replacement Measures.

²⁰ To gain access to the SharePoint web site, please contact the TRM Administrator at iltrmadministrator@veic.org.

3.3.1 LED Lamp and Linear Fluorescents Baseline Assumptions

Specific reductions in savings have been incorporated for LED measures that relate to the shift in appropriate baseline due to changes in Federal Standards for lighting products. Federal legislation (stemming from the Energy Independence and Security Act of 2007) mandated a phase-in process that began in 2012 for all general-purpose light bulbs (defined as omnidirectional or A-lamps) between 40W and 100W to be approximately 30% more energy efficient than current incandescent bulbs, in essence beginning the phase-out of the current style, or “standard”, incandescent bulbs. From 2012, standard 100W incandescent bulbs could no longer be manufactured, followed by restrictions on standard 75W bulbs in 2013 and 60W and 40W bulbs in 2014. The baseline for the CFL and LED Omnidirectional Lamp measure in the corresponding program years therefore became bulbs (improved or “efficient” incandescent, or halogen) that met the new standard and have the same lumen equivalency.

In addition, a backstop provision requires replacement baseline lamps meet 45 lumens/watt from 2020.

For Standard LED Lamps, due to the expected delay in clearing retail inventory, this shift under the EISA backstop provision is assumed to not to occur until 1/1/2022 for all but programs serving income eligible populations (see Income Eligible Program Adjustments below). After 12/31/2021, CFLs are assumed to no longer be available in the market, and thus the savings from standard LEDs will go to zero starting 1/1/2022. However, Utilities reserve the right to propose Super-Efficient LEDs that will accrue persisting savings beyond 1/1/2022, evaluated against a less efficient LED baseline. Due to varying efficacies of LED products available, consideration should be made for LEDs that are more efficient than the Energy Star baseline. It is assumed that manufacturers will not make LED products that are near the 45 lumens/watt EISA backstop, but the TAC realizes that this is a possibility given that the market beyond the EISA backstop provision is not yet realized.

Specialty and Directional lamps were not included in the original definition of General Service Lamps in the Energy Independence and Security Act of 2007 (EISA). Therefore, the initial baseline is an incandescent / halogen lamp described in that measure.

A DOE Final Rule released on 1/19/2017 updated the EISA regulations to remove the exemption for these lamp types such that they become subject to the backstop provision defined within the original legislation. However, in September 2019 this decision was revoked in a DOE Final Rule. There remains however significant uncertainty around the impact of potential legal challenges, as well as uncertainty regarding how the market for these products would change absent the backstop²¹. Therefore, the 2020 version of the LED Specialty Lamp measure delays application of the backstop provision to 1/1/2025 for all but programs serving income eligible populations (see Income Eligible Program Adjustments below). After 12/31/2024, CFLs are assumed to no longer be available in the market, and thus the savings from specialty LEDs will go to zero starting 1/1/2025. However, as per Standard lamps, Utilities reserve the right to propose Super-Efficient LEDs that will accrue persisting savings beyond 1/1/2025, evaluated against a less efficient LED baseline.

All parties commit to convening and participating in a working group to discuss, undertake necessary research, and develop consensus market forecasts to inform midlife adjustments to be made. This discussion will not be limited to using 2025 as the appropriate midlife adjustment year. If a consensus change is arrived at, changes can be made and applied retroactively to Jan. 1, 2020. In addition, if legal clarity emerges, the midlife adjustment issue can be revisited midyear; and if a consensus change is arrived at, changes can be made and applied retroactively to Jan. 1, 2020.

Income Eligible Program Adjustments

For both Standard and Specialty LEDs, savings are assumed not to go to zero until January 1, 2026 for all income eligible programs, except for DIY, Warehouse, and Big Box stores in Income Eligible Upstream Lighting programs. All

²¹ At the time of the completion of the TRM v8.0, a potential legal concern has been raised regarding whether and how the proposed Department of Energy standards and other Federal law, including 42 U.S.C. 6297, might constrain how the TRM treats lighting savings. Accordingly, the interested stakeholders agree that, notwithstanding the current TRM v8.0 language being proposed for approval to the Commission, each party reserves the right to raise or address the legal issues with the Commission, or in other arenas as needed, and should the parties reach consensus on the legal issues, the parties will reasonably work together to make any necessary changes to the TRM v.8 through an errata or other appropriate procedure.

parties commit to convening and participating in an Income Qualified Subcommittee working group to discuss, undertake necessary evaluation research, and develop consensus forecasts as to when midlife adjustments for Standard and Specialty LEDs for programs serving income eligible customers should be made. In addition to the broader question of when the midlife adjustments should occur for LEDs in income eligible programs, the group will also discuss and undertake the necessary evaluation research to lead to a decision as to whether LEDs purchased in DIY, Warehouse, and Big Box Income Eligible stores should also have a delayed baseline shift consistent with the other Income Eligible upstream lighting retailer types. If a consensus change is arrived at for DIY, Warehouse, and Big Box Income Eligible stores, changes can be made and applied retroactively to Jan. 1, 2020.

In July 14, 2012, Federal Standards were enacted that were expected to eliminate T-12s as an option for linear fluorescent fixtures. Through v3.0 of the TRM, it was assumed that the T-12 would no longer be baseline for retrofits from 1/1/2016. However, due to significant loopholes in the legislation, T-12 compliant product is still freely available, and in Illinois T-12s continue to hold a significant share of the existing market. Therefore, measures allow T12 as an existing fixture for early replacements, with a midlife adjustment to an assumed new baseline fixture after the assumed burn out of the existing fixture.

3.3.2 Early Replacement Baseline Assumptions

A series of measures have an option to choose an Early Replacement Baseline if the following conditions are met:

Early Replacement determination will be based on meeting the following conditions:

- The existing unit is operational when replaced, or
- The existing unit requires minor repairs (see table below) ²².

Existing System	Maximum repair cost
Air Source Heat Pump	\$918
Central Air Conditioner	\$734
Boiler	\$709
Furnace	\$528
Ground Source Heat Pump	<\$249 per ton

- All other conditions will be considered Time of Sale.

The Baseline efficiency of the existing unit replaced:

- If the efficiency of the existing unit is less than the maximum shown below, the Baseline efficiency is the actual efficiency value of the unit replaced. If the efficiency is greater than the maximum, the Baseline efficiency is shown in the “New Baseline” column below:

Existing System	Maximum efficiency for Actual	New Baseline
Air Source Heat Pump	10 SEER	14 SEER
Central Air Conditioner	10 SEER	13 SEER
Boiler	75% AFUE	82% AFUE
Furnace	75% AFUE	80% AFUE
Ground Source Heat Pump	10 SEER	13 SEER

- If the operational status, repair cost or efficiency of the existing unit is unknown, the Baseline efficiency is the “New Baseline” column above.

²² The Technical Advisory Committee agreed that if the cost of repair is less than 20% of the new baseline replacement cost it can be considered early replacement.

3.3.3 Furnace Baseline

The prior national standard for residential oil and gas furnaces was 78% AFUE. DOE raised the standard in 2007 to 80% AFUE, effective 2015. However, virtually all furnaces on the market have an AFUE of 80% or better, which prompted states and environmental and consumer groups to sue DOE over its 2007 decision. In April 2009, DOE accepted a “voluntary remand” in that litigation. In October 2009, manufacturers and efficiency advocates negotiated an agreement that, for the first time, included different standard levels in three climate regions: the North, South, and Southwest. DOE issued a direct final rule (DFR) in June 2011 reflecting the standard levels in the consensus agreement. The DFR became effective on October 25, 2011 establishing new standards: In the North, most furnaces will be required to have an AFUE of 90%. The 80% AFUE standard for the South and Southwest will remain unchanged at 80%. Oil furnaces will be required to have an AFUE of 83% in all three regions. The amended standards will become effective in May 2013 for non-weatherized furnaces and in January 2015 for weatherized furnaces. DOE estimates that the standards will save about 3.3 quads (quadrillion Btu) of energy over 30 years and yield a net present value of about \$14 billion at a 3 percent discount rate.

Update: On January 14th 2013, the U.S. Department of Energy (DOE) proposed to settle a lawsuit brought by the American Public Gas Association (APGA) that seeks to roll back gas furnace efficiency standards. As a result, the new standards, completed in 2011 and slated to take effect in May 2013, would be eliminated in favor of yet another round of DOE hearings and studies. Even if DOE completes a new rulemaking in two years, it's unlikely to take effect before 2020.²³

As a result, each of the furnace measures contains the following language describing the baseline assumption:

“Although the current Federal Standard for gas furnaces is an AFUE rating of 78%, based upon review of available product in the AHRI database, the baseline efficiency for this characterization is assumed to be 80%. The baseline will be adjusted when the Federal Standard is updated.”

3.4 Provisional Measures Savings Assumptions

As defined in the Glossary below, the term Provisional Measures refers to energy-efficient technologies, measures, projects, programs, and/or services that are generally nascent in Illinois or nationally, for which energy savings have not been validated through robust evaluation, measurement and verification (EM&V) efforts, and/or for which there is substantial uncertainty about their cost-effectiveness, performance, and/or customer acceptance. Because, by definition, information on savings for such measures or services is lacking, is based on limited information, or is currently subject to uncertainties, the development of robust assumptions for the TRM is challenging. In order to provide calculations for use as the final applicability of these measures is being determined, the TRM can include such measures on a provisional basis, with savings estimates based on the best currently available data or approach, as determined by the IL-TRM Administrator in consultation with the TAC. In such a case, the identifying tag “Provisional Measure” will be added to the TRM measure name. Provisional Measures will be given a one-year Review Deadline, meaning that the measure will undergo a review for reasonableness, continued program relevancy, and update of material assumptions during the following TRM update cycle. The tagging of a measure in the TRM as “Provisional Measure” will ultimately be a TAC decision, and any TRM measure which the TAC determines falls into this category may be assigned.

Expectations are that the Program Administrator will work with evaluators and the TRM Administrator to design and undertake pilot studies, evaluations, or other relevant activities on an appropriate number of installations of the Provisional Measure within that year, with the goal of informing the development of more-robust and Illinois-specific savings assumptions. Including savings estimates in the TRM for such Provisional Measures provides a benchmark to assess effectiveness and allows for tracking and reporting on their value to the programs and customers, even as they are being studied. Savings from any Provisional Measure will be verified by the evaluators as per the characterization included in the TRM for up to 1% of a Program Administrator’s portfolio of savings. If savings for any single Provisional Measure rises above 1% of portfolio savings, the additional savings above 1% would be subject to retroactive evaluation risk.

²³ Appliance Standards Awareness Project, <http://www.appliance-standards.org/product/furnaces>

3.5 Glossary

Baseline Efficiency: The assumed standard efficiency of equipment, absent an efficiency program.

Building Types²⁴:

Note where a measure installation is within a building or application that does not fit with any of the defined building types below, the user should apply custom assumptions where it is reasonable to estimate them, else the building of best fit should be used.

Building Type	Definition
Assisted Living MultiFamily	Applies to residential buildings of three or more units with staff to assist the occupants. Gross Floor Area should include all fully-enclosed space within the exterior walls of the building(s) including individual rooms or units, wellness centers, exam rooms, community rooms, small shops or service areas for residents and visitors (e.g. hair salons, convenience stores), staff offices, lobbies, atriums, cafeterias, kitchens, storage areas, hallways, basements, stairways, corridors between buildings, and elevator shafts.
Auditorium/Assembly	Applies to any performance space such as a theater, arena, or hall. Gross Floor Area should include all space within the building(s), including seating, stage and backstage areas, food service areas, retail areas, rehearsal studios, administrative/office space, mechanical rooms, storage areas, elevator shafts, and stairwells.
Childcare/Pre-school	Applies to any building providing childcare to pre-kindergarten age children.
College/University	Applies to facility space used for higher education. Relevant buildings include administrative headquarters, residence halls, athletic and recreation facilities, laboratories, etc. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Convenience Store	Applies to facility space used for the retail sale of a limited selection of food and beverage products. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated and non-refrigerated), and administrative areas.
Elementary School	Applies to a school serving children in any grades from Kindergarten through sixth grade. The total gross floor area should include all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoria, laboratory classrooms, portable classrooms, greenhouses, stairways, atria, elevator shafts, small landscaping sheds, storage areas, etc.
Exterior	Applies to unconditioned spaces that are outside of the building envelope.
Garage	Applies to unconditioned spaces either attached or detached from the primary building envelope that are not used for living space.
Grocery	Applies to facility space used for the retail sale of food and beverage products. It should not be used by restaurants. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated and non-refrigerated), administrative areas, stairwells, atria, lobbies, etc.
Healthcare Clinic	Applies to a facility space used to provide diagnosis and treatment for medical, dental, or psychiatric outpatient care. Gross Floor Area should include all space within the building(s) including offices, exam rooms, laboratories, lobbies, atriums, conference rooms and auditoriums, employee break rooms and kitchens, rest rooms, elevator shafts, stairways, mechanical rooms, and storage areas.
High School/Middle School	Applies to facility space used as a school building for 7th through 12th grade students. This does not include college or university classroom facilities and laboratories,

²⁴ Source: US EPA, www.energystar.gov, Space Type Definitions, or definitions as developed through the Technical Advisory Committee.

Building Type	Definition
	vocational, technical, or trade schools. The total gross floor area should include all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoria, laboratory classrooms, portable classrooms, greenhouses, stairways, atria, elevator shafts, small landscaping sheds, storage areas, etc.
Hospital	Applies to a general medical and surgical hospital (including critical access hospitals and children's hospitals) that is either a stand-alone building or a campus of buildings. Spaces more accurately characterized as a Healthcare Clinic should use that definition. The definition of Hospital accounts for all space types that are located within the Hospital building/campus, such as medical offices, administrative offices, and skilled nursing. The total floor area should include the aggregate floor area of all buildings on the campus as well as all supporting functions such as: stairways, connecting corridors between buildings, medical offices, exam rooms, laboratories, lobbies, atria, cafeterias, storage areas, elevator shafts, and any space affiliated with emergency medical care, or diagnostic care.
Hotel/Motel Combined (All Spaces)	Applies to buildings that rent overnight accommodations on a room/suite basis, typically including a bath/shower and other facilities in guest rooms. The total gross floor area should include all interior space, including guestrooms, halls, lobbies, atria, food preparation and restaurant space, conference and banquet space, health clubs/spas, indoor pool areas, and laundry facilities, as well as all space used for supporting functions such as elevator shafts, stairways, mechanical rooms, storage areas, employee break rooms, back-of-house offices, etc. Hotel does not apply to fractional ownership properties such as condominiums or vacation timeshares. Hotel properties should be owned by a single entity and have rooms available on a nightly basis. Where distinction between Hotel and Motel is necessary: Hotel: Room entrances and Corridors are located in the <i>interior</i> of the building. Corridors are conditioned spaces. Building can be significantly larger in size/height. Motel: Room entrances and Corridors are located on the <i>exterior</i> of the building. Corridors are not conditioned spaces. Buildings tend to be two to three stories in height.
Hotel/Motel Common Areas	All the common areas open to guests of the hotel such as the lobby, corridors and stairways, and other spaces that may have continuous or large lighting and HVAC hours.
Hotel/Motel Guest Room	Applies to the guest rooms of the hotel or motel. These spaces are occupied intermittently.
Low-use Small Business	Any business type with low (<3000) operating hours (provided as option in lighting measures).
Manufacturing	Applies to buildings that are dedicated to manufacturing activities. Includes light industry buildings characterized by consumer product and component manufacturing and heavy industry buildings typically characterized by a plant that includes a main production area that has high-ceilings and contains heavy equipment used for assembly line production. These building types may be distinguished by categorizing NAICS (SIC) codes according to the needs of the Program Administrator.
Miscellaneous	Applies to spaces that do not fit clearly within any available categories should be designated as "miscellaneous".
Mobile Home	A mobile home is a prefabricated structure, built in a factory on a permanently attached chassis before being transported to site. Use single family assumptions throughout the TRM unless otherwise specified.
Movie Theater	Applies to buildings used for public or private film screenings. Gross Floor Area should include all space within the building(s), including seating areas, lobbies, concession stands, bathrooms, administrative/office space, mechanical rooms, storage areas, elevator shafts, and stairwells.

Building Type	Definition
Multifamily-Mid Rise	Applies to residential buildings with up to four floors, including all public and multiuse spaces within the building envelope. Small Multifamily buildings best described as a house should use the residential measure characterizations.
Multifamily-High Rise Combined (All Spaces)	Applies to residential buildings with five or more floors, including all public and multiuse spaces within the building envelope. Gross Floor Area should include all fully-enclosed space within the exterior walls of the building(s) including living space in each unit (including occupied and unoccupied units), interior common areas (e.g. lobbies, offices, community rooms, common kitchens, fitness rooms, indoor pools), hallways, stairwells, elevator shafts, connecting corridors between buildings, storage areas, and mechanical space such as a boiler room. Open air stairwells, breezeways, and other similar areas that are not fully-enclosed should not be included in the Gross Floor Area.
Multifamily-High Rise Common Areas	All the common areas open to occupants of the building such as the lobby, corridors and stairways, and other spaces that may have continuous or high lighting and HVAC hours.
Multifamily-High Rise Residential Units	Applies to the residential units in the building only.
Office-Low Rise	Applies to facility spaces in buildings with four floors or fewer used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Office-Mid Rise	Applies to facility spaces in buildings with five to nine floors used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Office-High Rise	Applies to facility spaces in buildings with ten floors or more used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Religious Worship/Church	Applies to buildings that are used as places of worship. This includes churches, temples, mosques, synagogues, meetinghouses, or any other buildings that primarily function as a place of religious worship. Gross Floor Area should include all areas inside the building that includes the primary worship area, including food preparation, community rooms, classrooms, and supporting areas such as restrooms, storage areas, hallways, and elevator shafts.
Restaurant	Applies to a subcategory of Retail/Service space that is used to provide commercial food services to individual customers, and includes kitchen, dining, and common areas.
Retail/Service- Department store	Applies to facility space used to conduct the retail sale of consumer product goods. Stores must be at least 30,000 square feet and have an exterior entrance to the public. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, etc. Retail segments typically included under this definition are: Department Stores, Discount Stores, Supercenters, Warehouse Clubs, Drug Stores, Dollar Stores, Home Center/Hardware Stores, and Apparel/Hard Line Specialty Stores (e.g., books, clothing, office products, toys, home goods, electronics). Retail segments excluded under this definition are: Grocery, Convenience Stores, Automobile Dealerships, and Restaurants.
Retail/Service- Strip Mall	Applies to facility space used to conduct the retail sale of consumer product goods. Stores must less than 30,000 square feet and have an exterior entrance to the public. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, etc. Retail segments excluded under this definition are: Grocery, Convenience Stores, Automobile Dealerships, and Restaurants.

Building Type	Definition
Warehouse	Applies to unrefrigerated or refrigerated buildings that are used to store goods, manufactured products, merchandise or raw materials. The total gross floor area of Refrigerated Warehouses should include all temperature controlled area designed to store perishable goods or merchandise under refrigeration at temperatures below 50 degrees Fahrenheit. The total gross floor area of Unrefrigerated Warehouses should include space designed to store non-perishable goods and merchandise. Unrefrigerated warehouses also include distribution centers. The total gross floor area of refrigerated and unrefrigerated warehouses should include all supporting functions such as offices, lobbies, stairways, rest rooms, equipment storage areas, elevator shafts, etc. Existing atriums or areas with high ceilings should only include the base floor area that they occupy. The total gross floor area of refrigerated or unrefrigerated warehouse should not include outside loading bays or docks. Self-storage facilities, or facilities that rent individual storage units, are not eligible for a rating using the warehouse model.

Coincidence Factor (CF): Coincidence factors represent the fraction of connected load expected to be coincident with a particular system peak period, on a diversified basis. Coincidence factors are provided for summer peak periods.

Commercial & Industrial: The market sector that includes measures that apply to any of the building types defined in this TRM, which includes multifamily common areas and public housing²⁵.

Connected Load: The maximum wattage of the equipment, under normal operating conditions.

Deemed Value: A value that has been assumed to be representative of the average condition of an input parameter.

Default Value: When a measure indicates that an input to a prescriptive saving algorithm may take on a range of values, an average value is also provided in many cases. This value is considered the default input to the algorithm, and should be used when the other alternatives listed in the measure are not applicable.

End-use Category: A general term used to describe the categories of equipment that provide a service to an individual or building. See Table 2.1 for a list of the end-use categories that are incorporated in this TRM.

Energy Efficiency: "Energy efficiency" means measures that reduce the amount of electricity or natural gas consumed in order to achieve a given end use. "Energy efficiency" includes voltage optimization measures that optimize the voltage at points on the electric distribution voltage system and thereby reduce electricity consumption by electric customers' end use devices. "Energy efficiency" also includes measures that reduce the total Btus of electricity, natural gas and other fuels needed to meet the end use or uses (20 ILCS 3855/1-10). For purposes of this Section, "energy efficiency" means measures that reduce the amount of energy required to achieve a given end use. "Energy efficiency" also includes measures that reduce the total Btus of electricity and natural gas needed to meet the end use or uses (220 ILCS 5/8-104(b)).

Equivalent Full Load Hours (EFLH): The equivalent hours that equipment would need to operate at its peak capacity in order to consume its estimated annual kWh consumption (annual kWh/connected kW) or therms.

High Efficiency: General term for technologies and processes that require less energy, water, or other inputs to operate.

Lifetime: The number of years (or hours) that the new high efficiency equipment is expected to function. These are generally based on engineering lives, but sometimes adjusted based on expectations about frequency of removal, remodeling or demolition. Two important distinctions fall under this definition; Effective Useful Life (EUL) and Remaining Useful Life (RUL).

EUL – EUL is based on the manufacturers rating of the effective useful life; how long the equipment will

²⁵ Measures that apply to the multifamily and public housing building types describe how to handle tenant versus master metered buildings.

last. For example, a CFL that operates x hours per year will typically have an EUL of y. A house boiler may have a lifetime of 20 years but the EUL is only 15 years since after that time it may be operating at a non-efficient point. An estimate of the median number of years that the measures installed under a program are still in place and operable.

RUL – Applies to retrofit or replacement measures. For example, if an existing working refrigerator is replaced with a high efficiency unit, the RUL is an assumption of how many more years the existing unit would have lasted. As a general rule the RUL is usually assumed to be 1/3 of the EUL.

Load Factor (LF): The fraction of full load (wattage) for which the equipment is typically run.

Measure Cost: The incremental (for time of sale measures) or full cost (both capital and labor for retrofit measures) of implementing the High Efficiency equipment. See Section 3.8 Measure Incremental Cost Definition for full definition.

Measure Description: A detailed description of the technology and the criteria it must meet to be eligible as an energy efficient measure.

Measure: An efficient technology or procedure that results in energy savings as compared to the baseline efficiency.

Residential: The market sector that includes measures that apply only to detached, residential buildings or duplexes.

Operation and Maintenance (O&M) Cost Adjustments: The dollar impact resulting from differences between baseline and efficient case Operation and Maintenance costs.

Operating Hours (HOURS): The annual hours that equipment is expected to operate.

Provisional Measures: Energy-efficient technologies, measures, projects, programs, and/or services that are generally nascent in Illinois or nationally, for which energy savings have not been validated through robust evaluation, measurement, and verification (EM&V) efforts, and/or for which there is substantial uncertainty about their cost-effectiveness, performance, and/or customer acceptance.

Program: The mode of delivering a particular measure or set of measures to customers. See Table 2.4 for a list of program descriptions that are presently operating in Illinois.

Rating Period Factor (RPF): Percentages for defined times of the year that describe when energy savings will be realized for a specific measure.

Stakeholder Advisory Group (SAG): The Illinois Energy Efficiency Stakeholder Advisory Group (SAG) was first defined in the electric utilities' first energy efficiency Plan Orders to include "... the Utility, DCEO, Staff, the Attorney General, BOMA and CUB and representation from a variety of interests, including residential consumers, business consumers, environmental and energy advocacy organizations, trades and local government... [and] a representative from the ARES (alternative retail electric supplier) community should be included."²⁶ A group of stakeholders who have an interest in Illinois' energy efficiency programs and who meet regularly to share information and work toward consensus on various energy efficiency issues. The Utilities in Illinois have been directed by the ICC to work with the SAG on the development of a statewide TRM.

Table 3.1: Degree-Day Zones and Values by Market Sector

Zone	Residential		C&I		Weather Station / City
	HDD	CDD	HDD	CDD	
1	5,352	820	4,272	2,173	Rockford AP / Rockford
2	5,113	842	4,029	2,181	Chicago O'Hare AP / Chicago
3	4,379	1,108	3,406	2,666	Springfield #2 / Springfield

²⁶ ICC Docket No. 07-0540, Final Order at 32-33, February 6, 2008.
<http://www.icc.illinois.gov/downloads/public/edocket/215193.pdf>

Zone	Residential		C&I		Weather Station / City
	HDD	CDD	HDD	CDD	
4	3,378	1,570	2,515	3,358	Belleville SIU RSCH / Belleville
5	3,438	1,370	2,546	3,090	Carbondale Southern IL AP / Marion
Average	4,860	947	3,812	2,362	Weighted by occupied housing units
Base Temp	60F	65F	55F	55F	Year climate normals, 1981-2010

3.6 Electrical Loadshapes (kWh)

Loadshapes are an integral part of the measure characterization and are used to divide energy savings into appropriate periods using Rating Period Factors (RPFs) such that each have variable avoided cost values allocated to them for the purpose of estimating cost effectiveness.

For the purposes of assigning energy savings (kWh) periods, the TRM TAC has agreed to use the industry standards for wholesale power market transactions as shown in the following table.

Table 3.2: On- and Off-Peak Energy Definitions

Period Category	Period Definition (Central Prevailing Time)
Winter On-Peak Energy	8AM - 11PM, weekdays, Oct – Apr, No NERC holidays
Winter Off-Peak Energy	All other hours
Summer On-Peak Energy	8AM - 11PM, weekdays, May – Sept, No NERC holidays
Summer Off-Peak Energy	All other hours

Loadshapes have been developed for each end-use by assigning Rating Period Factor percentages to each of the four periods above. Three methodologies were used:

1. Itron eShapes data for Missouri, provided by Ameren and reconciled to Illinois loads, were used to calculate the percentage of load in to the four categories above.
2. Where the Itron eShapes data did not provide a particular end-use or specific measure load profile, loadshapes that have been developed over many years by Efficiency Vermont and that have been reviewed by the Vermont Department of Public Service were adjusted to match Illinois period definitions. Note – no weather sensitive loadshapes were based on this method. Any of these load profiles that relate to High Impact Measures should be an area of future evaluation.
3. Loadshapes have also been developed from primary research studies conducted in Illinois or other jurisdictions if robust datasets were available to support hourly analysis of end use consumption.

The following pages provide the loadshape values for most measures provided in the TRM²⁷. The source of the loadshape is also provided.

ComEd uses the DSMore™ (Integral Analytics DSMore™ Demand Side Management Option/Risk Evaluator) software to screen the efficiency measures for cost effectiveness. Since this tool requires a loadshape value for weekdays and weekends in each month (i.e., 24 inputs), the percentages for the four period categories above were calculated by weighting the proportion of weekdays/weekends in each month to the total within each period. The results of these

²⁷ All loadshape information has been posted to the VEIC SharePoint site, and is publicly accessible through the Stakeholder Advisory Group's web site. <http://www.ilsag.info/technical-reference-manual.html>
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Residential_Loadshapes_References.zip
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Commercial_Loadshapes_References.zip
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_3/Final_Draft/Sources%20and%20References%20-%20Loadshapes/TRM_Version_3_Loadshapes_2.24.zip
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/2018_Loadshape_Files.zip

calculations are also provided below.

Table 3.3: Loadshapes by Season

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak	
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time	Loadshape Source
Residential Clothes Washer	R01	30.1%	27.1%	23.1%	19.7%	Navigant MA Baseline Study ²⁸
Residential Dish Washer	R02	32.2%	28.5%	20.6%	18.7%	Navigant MA Baseline Study
Residential Electric DHW	R03	33.8%	31.0%	18.2%	17.1%	Navigant MA Baseline Study
Residential Freezer	R04	23.3%	30.2%	20.4%	26.0%	Navigant MA Baseline Study
Residential Refrigerator	R05	23.7%	28.7%	21.7%	25.9%	Navigant MA Baseline Study
Residential Indoor Lighting	R06	35.1%	26.1%	22.0%	16.8%	Opinion Dynamics IL Metering Study ²⁹
Residential Outdoor Lighting	R07	18.0%	44.1%	9.4%	28.4%	Efficiency Vermont
Residential Cooling	R08	4.1%	0.7%	71.3%	23.9%	Itron eShapes
Residential Electric Space Heat	R09	57.8%	38.8%	1.7%	1.7%	Itron eShapes
Residential Electric Heating and Cooling	R10	35.2%	22.8%	31.0%	11.0%	Itron eShapes
Residential Ventilation	R11	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Residential - Dehumidifier	R12	12.9%	16.2%	31.7%	39.2%	Efficiency Vermont
Residential Standby Losses - Entertainment Center	R13	28.3%	30.3%	19.7%	21.7%	Navigant MA Baseline Study
Residential Standby Losses - Home Office	R14	28.8%	28.3%	21.4%	21.4%	Navigant MA Baseline Study
Residential Pool Pumps	R15	0%	0%	58.9%	41.1%	Efficiency Vermont
Residential Holiday String Lighting	R16	43.1%	56.9%	0%	0%	Estimate ³⁰
Residential Electric Dryer	R17	34.0%	26.0%	22.3%	17.7%	Navigant MA Baseline Study
Residential Heat Pump DHW	R18	32.8%	31.1%	18.2%	17.9%	Navigant MA Baseline Study
Commercial Electric Cooking	C01	40.6%	18.2%	28.7%	12.6%	Itron eShapes
Commercial Electric DHW	C02	40.5%	18.2%	28.5%	12.8%	Itron eShapes
Commercial Cooling	C03	4.9%	0.8%	66.4%	27.9%	Itron eShapes

²⁸ See "RES 1 Baseline Loadshape Study" Prepared for the Electric and Gas Program Administrators of Massachusetts, Navigant, July 27, 2018, and corresponding Excel Appendix files.

²⁹ See 'IL Res Indoor LED Lighting Load Shape_2018-06-06' and 'IL Res Indoor LED Lighting Load Shape Development Methodology_2018-05-18' for details.

³⁰ Based on average of Residential Indoor and Outdoor lighting winter usage only.

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak	
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time	Loadshape Source
Commercial Electric Heating	C04	53.5%	43.2%	1.9%	1.4%	Itron eShapes
Commercial Electric Heating and Cooling	C05	19.4%	13.5%	47.1%	19.9%	Itron eShapes
Commercial Indoor Lighting	C06	30.1%	27.5%	22.8%	19.7%	Navigant EmPOWER study ³¹
Grocery/Conv. Store Indoor Lighting	C07	28.0%	30.2%	20.3%	21.5%	Navigant EmPOWER study
Health Indoor Lighting	C08	29.1%	28.9%	21.6%	20.3%	Navigant EmPOWER study
Office Indoor Lighting	C09	29.9%	28.2%	22.3%	19.6%	Navigant EmPOWER study
Restaurant Indoor Lighting	C10	32.1%	25.7%	23.4%	18.8%	Efficiency Vermont
Retail Indoor Lighting	C11	32.6%	25.4%	24.2%	17.9%	Navigant EmPOWER study
Warehouse Indoor Lighting	C12	26.0%	29.0%	22.4%	22.6%	Navigant EmPOWER study
Education Indoor Lighting	C13	34.7%	26.2%	23.6%	15.5%	Navigant EmPOWER study
Indust. 1-shift (8/5) (e.g., comp. air, lights)	C14	50.5%	7.2%	37.0%	5.3%	Efficiency Vermont
Indust. 2-shift (16/5) (e.g., comp. air, lights)	C15	47.5%	10.2%	34.8%	7.4%	Efficiency Vermont
Indust. 3-shift (24/5) (e.g., comp. air, lights)	C16	34.8%	23.2%	25.5%	16.6%	Efficiency Vermont
Indust. 4-shift (24/7) (e.g., comp. air, lights)	C17	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Industrial Indoor Lighting	C18	44.3%	13.6%	32.4%	9.8%	Efficiency Vermont
Industrial Outdoor Lighting	C19	18.0%	44.1%	9.4%	28.4%	Efficiency Vermont
Commercial Outdoor Lighting	C20	16.8%	44.6%	9.3%	29.3%	Navigant EmPOWER study
Commercial Office Equipment	C21	37.7%	20.9%	26.7%	14.7%	Itron eShapes
Commercial Refrigeration	C22	38.5%	20.6%	26.7%	14.2%	Itron eShapes
Commercial Ventilation	C23	38.1%	20.6%	29.7%	11.6%	Itron eShapes
Traffic Signal - Red Balls, always changing or flashing	C24	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - Red Balls, changing day, off night	C25	37.0%	20.9%	27.1%	14.9%	Efficiency Vermont
Traffic Signal - Green Balls, always changing	C26	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - Green Balls, changing day, off night	C27	37.0%	20.9%	27.1%	14.9%	Efficiency Vermont
Traffic Signal - Red Arrows	C28	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - Green Arrows	C29	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - Flashing Yellows	C30	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont

³¹ See '3.5 Electrical Load Shapes_IL TRM Workpape_CI_Ltg_2018-06-28' and 'IL Commercial Lighting Load Shape Development Methodology_2018-06-28' for details.

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak	
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time	Loadshape Source
Traffic Signal - “Hand” Don’t Walk Signal	C31	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - “Man” Walk Signal	C32	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Traffic Signal - Bi-Modal Walk/Don’t Walk	C33	25.8%	32.3%	18.9%	23.0%	Efficiency Vermont
Industrial Motor	C34	47.5%	10.2%	34.8%	7.4%	Efficiency Vermont
Industrial Process	C35	47.5%	10.2%	34.8%	7.4%	Efficiency Vermont
HVAC Pump Motor (heating)	C36	38.7%	48.6%	5.9%	6.8%	Efficiency Vermont
HVAC Pump Motor (cooling)	C37	7.8%	9.8%	36.8%	45.6%	Efficiency Vermont
HVAC Pump Motor (unknown use)	C38	23.2%	29.2%	21.4%	26.2%	Efficiency Vermont
VFD - Supply fans <10 HP	C39	38.8%	16.1%	28.4%	16.7%	Efficiency Vermont
VFD - Return fans <10 HP	C40	38.8%	16.1%	28.4%	16.7%	Efficiency Vermont
VFD - Exhaust fans <10 HP	C41	34.8%	23.2%	20.3%	21.7%	Efficiency Vermont
VFD - Boiler feedwater pumps <10 HP	C42	42.9%	44.2%	6.6%	6.3%	Efficiency Vermont
VFD - Chilled water pumps <10 HP	C43	11.2%	5.5%	40.7%	42.6%	Efficiency Vermont
VFD Boiler circulation pumps <10 HP	C44	42.9%	44.2%	6.6%	6.3%	Efficiency Vermont
Refrigeration Economizer	C45	36.3%	50.8%	5.6%	7.3%	Efficiency Vermont
Evaporator Fan Control	C46	24.0%	35.9%	16.7%	23.4%	Efficiency Vermont
Standby Losses - Commercial Office	C47	8.2%	50.5%	5.6%	35.7%	Efficiency Vermont
VFD Boiler draft fans <10 HP	C48	37.3%	48.9%	6.4%	7.3%	Efficiency Vermont
VFD Cooling Tower Fans <10 HP	C49	7.9%	5.2%	54.0%	32.9%	Efficiency Vermont
Engine Block Heater Timer	C50	26.5%	61.0%	4.1%	8.5%	Efficiency Vermont
Door Heater Control	C51	30.4%	69.6%	0.0%	0.0%	Efficiency Vermont
Beverage and Snack Machine Controls	C52	10.0%	48.3%	7.4%	34.3%	Efficiency Vermont
Flat	C53	36.3%	21.8%	26.2%	15.7%	Ittron eShapes
Religious Indoor Lighting	C54	26.8%	31.4%	18.9%	22.8%	Efficiency Vermont
Commercial Clothes Washer	C55	47.0%	11.1%	34.0%	8.0%	Ittron eShapes ³²
Dairy Farm Combined End Uses	C56	34.2%	23.9%	24.9%	17.0%	Efficiency Vermont
Milk Pump	C57	29.5%	28.9%	21.3%	20.3%	Efficiency Vermont
Farm Plate Cooler / Heat Recovery Unit	C58	22.8%	16.7%	32.4%	28.1%	Efficiency Vermont
Agriculture and Water Pumping	C59	23.7%	36.0%	18.3%	22.0%	DEER 2008

³² Assumed equal to R01 Residential Clothes Washer loadshape.

Table 3.4: Loadshapes by Month and Day of Week

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Residential Clothes Washer	R01	5.1%	3.0%	4.9%	2.5%	5.7%	2.5%	6.0%	3.7%	6.2%	3.1%	5.7%	2.6%	5.3%	3.6%	5.8%	2.5%	4.9%	3.1%	5.2%	2.7%	5.0%	2.7%	4.8%	3.4%
Residential Dish Washer	R02	6.1%	3.3%	5.1%	2.4%	6.1%	2.4%	5.5%	3.1%	5.6%	2.6%	5.3%	2.2%	4.8%	3.1%	5.5%	2.2%	5.0%	2.9%	5.7%	2.7%	5.9%	2.9%	5.8%	3.6%
Residential Electric DHW	R03	7.1%	3.4%	6.7%	2.7%	7.4%	2.6%	5.9%	3.0%	5.8%	2.4%	5.1%	1.9%	4.3%	2.4%	4.8%	1.7%	4.5%	2.3%	5.5%	2.3%	5.8%	2.6%	6.1%	3.4%
Residential Freezer	R04	4.8%	2.3%	4.7%	1.9%	5.8%	2.0%	5.7%	2.8%	6.2%	2.5%	6.4%	2.4%	6.4%	3.5%	7.5%	2.6%	6.0%	3.0%	6.1%	2.5%	5.4%	2.3%	4.7%	2.6%
Residential Refrigerator	R05	5.0%	2.4%	4.6%	1.9%	5.5%	1.9%	5.1%	2.5%	6.1%	2.4%	6.6%	2.5%	6.9%	3.7%	7.7%	2.7%	5.9%	3.1%	5.9%	2.4%	5.3%	2.3%	4.8%	2.7%
Residential Indoor Lighting	R06	5.9%	2.7%	5.7%	2.2%	6.5%	2.2%	5.5%	2.7%	5.8%	2.5%	5.1%	1.9%	4.8%	2.4%	5.6%	2.0%	5.9%	3.0%	6.6%	2.7%	6.4%	2.8%	5.9%	3.3%
Residential Outdoor Lighting	R07	2.7%	6.2%	2.4%	5.9%	2.6%	7.0%	2.6%	6.0%	1.9%	5.7%	1.8%	5.8%	2.0%	5.3%	1.9%	6.0%	1.8%	5.7%	2.7%	6.0%	2.5%	6.6%	2.6%	6.4%
Residential Cooling	R08	0.6%	0.1%	0.5%	0.1%	0.6%	0.1%	0.6%	0.1%	14.6%	4.8%	13.7%	4.9%	14.9%	4.5%	14.2%	5.0%	13.9%	4.8%	0.6%	0.1%	0.6%	0.1%	0.6%	0.1%
Residential Electric Space Heat	R09	8.6%	5.5%	7.7%	5.1%	8.2%	6.1%	8.3%	5.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.3%	8.7%	5.3%	8.0%	5.8%	8.5%	5.6%
Residential Electric Heating and Cooling	R10	5.2%	3.2%	4.7%	3.0%	5.0%	3.6%	5.0%	3.1%	6.3%	2.2%	6.0%	2.3%	6.5%	2.1%	6.2%	2.3%	6.0%	2.2%	5.3%	3.1%	4.9%	3.4%	5.2%	3.3%
Residential Ventilation	R11	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Residential - Dehumidifier	R12	1.9%	2.3%	1.7%	2.2%	1.8%	2.6%	1.8%	2.2%	6.5%	7.8%	6.1%	8.0%	6.6%	7.3%	6.3%	8.2%	6.2%	7.8%	1.9%	2.2%	1.8%	2.4%	1.9%	2.4%
Residential Standby Losses - Entertainment Center	R13	5.7%	2.9%	5.5%	2.4%	6.2%	2.3%	5.3%	2.9%	5.9%	2.6%	5.9%	2.3%	5.2%	3.1%	6.0%	2.3%	5.4%	2.9%	5.9%	2.6%	5.5%	2.6%	5.5%	3.3%
Residential Standby	R14	5.9%	2.8%	5.6%	2.2%	6.0%	2.0%	5.2%	2.6%	5.7%	2.3%	6.6%	2.4%	6.2%	3.4%	6.7%	2.3%	4.7%	2.3%	5.7%	2.3%	6.0%	2.5%	5.5%	3.0%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Losses - Home Office																									
Residential Holiday String Lighting	R16	9%	11%	2%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%	9%	11%	22%	28%
Residential Electric Dryer	R17	5.7%	3.6%	5.2%	2.7%	5.9%	2.7%	5.0%	3.3%	5.8%	3.1%	5.4%	2.6%	4.5%	3.4%	5.1%	2.4%	4.5%	3.1%	5.1%	2.9%	5.6%	3.1%	5.3%	3.8%
Residential Heat Pump DHW	R18	6.9%	3.3%	6.6%	2.6%	7.3%	2.5%	5.9%	3.0%	5.8%	2.4%	5.2%	1.9%	4.4%	2.5%	5.0%	1.8%	4.6%	2.3%	5.6%	2.3%	5.9%	2.6%	6.1%	3.3%
Commercial Electric Cooking	C01	6.0%	2.6%	5.4%	2.4%	5.7%	2.9%	5.8%	2.5%	5.9%	2.5%	5.5%	2.6%	6.0%	2.4%	5.7%	2.6%	5.6%	2.5%	6.1%	2.5%	5.6%	2.7%	5.9%	2.6%
Commercial Electric DHW	C02	6.0%	2.6%	5.4%	2.4%	5.7%	2.9%	5.8%	2.5%	5.8%	2.5%	5.5%	2.6%	6.0%	2.4%	5.7%	2.7%	5.6%	2.5%	6.1%	2.5%	5.6%	2.7%	5.9%	2.6%
Commercial Cooling	C03	0.7%	0.1%	0.6%	0.1%	0.7%	0.1%	0.7%	0.1%	13.6%	5.5%	12.8%	5.7%	13.9%	5.2%	13.3%	5.9%	13.0%	5.5%	0.7%	0.1%	0.7%	0.1%	0.7%	0.1%
Commercial Electric Heating	C04	7.9%	6.1%	7.1%	5.7%	7.6%	6.8%	7.7%	5.9%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	8.0%	5.9%	7.4%	6.5%	7.8%	6.3%
Commercial Electric Heating and Cooling	C05	2.9%	1.9%	2.6%	1.8%	2.8%	2.1%	2.8%	1.9%	9.6%	4.0%	9.1%	4.1%	9.8%	3.7%	9.4%	4.2%	9.2%	4.0%	2.9%	1.9%	2.7%	2.0%	2.8%	2.0%
Commercial Indoor Lighting	C06	5.5%	2.8%	5.2%	2.3%	6.2%	2.2%	5.4%	2.7%	6.1%	2.4%	6.2%	2.3%	5.5%	3.0%	6.5%	2.2%	5.5%	2.7%	5.9%	2.5%	5.7%	2.5%	5.4%	3.1%
Grocery/Conv. Store Indoor Lighting	C07	5.7%	2.8%	5.5%	2.2%	6.3%	2.2%	5.5%	2.8%	6.0%	2.5%	6.0%	2.2%	5.4%	3.0%	6.3%	2.2%	5.5%	2.8%	6.0%	2.5%	5.7%	2.5%	5.5%	3.0%
Health Indoor Lighting	C08	5.4%	2.9%	5.3%	2.4%	6.4%	2.2%	5.5%	2.7%	6.0%	2.4%	6.0%	2.1%	5.5%	3.0%	6.4%	2.3%	5.5%	2.7%	6.0%	2.4%	5.8%	2.4%	5.2%	3.3%
Office Indoor Lighting	C09	5.2%	3.0%	5.1%	2.6%	6.3%	2.4%	5.3%	3.0%	5.7%	2.6%	6.0%	2.4%	5.3%	3.2%	6.3%	2.3%	5.2%	2.9%	5.5%	2.7%	5.5%	2.8%	5.2%	3.3%
Restaurant Indoor Lighting	C10	4.8%	3.6%	4.3%	3.4%	4.5%	4.1%	4.6%	3.5%	4.8%	3.7%	4.5%	3.8%	4.9%	3.5%	4.7%	4.0%	4.6%	3.7%	4.8%	3.5%	4.4%	3.8%	4.7%	3.7%
Retail Indoor	C11	5.6%	2.8%	5.4%	2.3%	6.3%	2.3%	5.5%	2.8%	6.0%	2.5%	6.0%	2.2%	5.4%	3.0%	6.4%	2.3%	5.5%	2.7%	5.9%	2.5%	5.7%	2.5%	5.5%	3.1%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Lighting																									
Warehouse Indoor Lighting	C12	5.4%	2.8%	4.7%	2.1%	5.8%	1.9%	5.0%	2.3%	6.5%	2.3%	7.1%	2.2%	6.2%	2.8%	7.3%	2.2%	5.8%	2.6%	6.0%	2.3%	5.9%	2.4%	5.3%	3.2%
Education Indoor Lighting	C13	5.1%	2.8%	5.7%	3.3%	7.8%	1.9%	6.9%	2.5%	7.2%	2.1%	5.5%	1.6%	4.2%	1.7%	6.4%	1.6%	6.3%	2.4%	6.6%	2.1%	6.2%	2.1%	4.9%	3.0%
Indust. 1-shift (8/5) (e.g., comp. air, lights)	C14	7.5%	1.0%	6.7%	1.0%	7.1%	1.1%	7.2%	1.0%	7.5%	1.1%	7.1%	1.1%	7.7%	1.0%	7.4%	1.1%	7.2%	1.1%	7.6%	1.0%	7.0%	1.1%	7.4%	1.0%
Indust. 2-shift (16/5) (e.g., comp. air, lights)	C15	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
Indust. 3-shift (24/5) (e.g., comp. air, lights)	C16	5.1%	3.3%	4.6%	3.1%	4.9%	3.7%	5.0%	3.2%	5.2%	3.3%	4.9%	3.4%	5.3%	3.1%	5.1%	3.5%	5.0%	3.3%	5.2%	3.2%	4.8%	3.5%	5.1%	3.4%
Indust. 4-shift (24/7) (e.g., comp. air, lights)	C17	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Industrial Indoor Lighting	C18	6.6%	1.9%	5.9%	1.8%	6.3%	2.1%	6.3%	1.9%	6.6%	1.9%	6.2%	2.0%	6.8%	1.8%	6.5%	2.0%	6.3%	1.9%	6.6%	1.9%	6.1%	2.0%	6.5%	2.0%
Industrial Outdoor Lighting	C19	2.7%	6.2%	2.4%	5.9%	2.6%	7.0%	2.6%	6.0%	1.9%	5.7%	1.8%	5.8%	2.0%	5.3%	1.9%	6.0%	1.8%	5.7%	2.7%	6.0%	2.5%	6.6%	2.6%	6.4%
Commercial Outdoor Lighting	C20	6.1%	3.2%	6.3%	2.5%	6.8%	2.4%	5.3%	2.7 %	5.8%	2.4%	5.2%	1.9%	4.8%	2.6%	5.8%	2.0%	5.5%	2.7 %	6.0%	2.5%	5.8%	2.5%	6.0%	3.4%
Commercial Office Equipment	C21	5.6%	3.0%	5.0%	2.8%	5.3%	3.3%	5.4%	2.9%	5.4%	2.9%	5.1%	3.0%	5.6%	2.7%	5.3%	3.1%	5.2%	2.9%	5.6%	2.9%	5.2%	3.1%	5.5%	3.0%
Commercial Refrigeration	C22	5.7%	2.9%	5.1%	2.7%	5.4%	3.2%	5.5%	2.8%	5.5%	2.8%	5.1%	2.9%	5.6%	2.7%	5.3%	3.0%	5.2%	2.8%	5.8%	2.8%	5.3%	3.1%	5.6%	3.0%
Commercial Ventilation	C23	5.6%	2.9%	5.1%	2.7%	5.4%	3.3%	5.4%	2.8%	6.1%	2.3%	5.7%	2.4%	6.2%	2.2%	5.9%	2.4%	5.8%	2.3%	5.7%	2.8%	5.3%	3.1%	5.6%	3.0%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Traffic Signal - Red Balls, always changing or flashing	C24	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Red Balls, changing day, off night	C25	5.5%	2.9%	4.9%	2.8%	5.2%	3.3%	5.3%	2.9%	5.5%	3.0%	5.2%	3.1%	5.7%	2.8%	5.4%	3.1%	5.3%	3.0%	5.5%	2.9%	5.1%	3.1%	5.4%	3.0%
Traffic Signal - Green Balls, always changing	C26	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Green Balls, changing day, off night	C27	5.5%	2.9%	4.9%	2.8%	5.2%	3.3%	5.3%	2.9%	5.5%	3.0%	5.2%	3.1%	5.7%	2.8%	5.4%	3.1%	5.3%	3.0%	5.5%	2.9%	5.1%	3.1%	5.4%	3.0%
Traffic Signal - Red Arrows	C28	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Green Arrows	C29	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Flashing Yellows	C30	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - "Hand" Don't Walk Signal	C31	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - "Man" Walk Signal	C32	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Bi-Modal Walk/Don't Walk	C33	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Industrial Motor	C34	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
Industrial Process	C35	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
HVAC Pump	C36	5.7%	6.9%	5.2%	6.4%	5.5%	7.7%	5.5%	6.6%	1.2%	1.4%	1.1%	1.4%	1.2%	1.3%	1.2%	1.4%	1.2%	1.4%	5.8%	6.6%	5.3%	7.3%	5.7%	7.1%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Motor (heating)																									
HVAC Pump Motor (cooling)	C37	1.2%	1.4%	1.0%	1.3%	1.1%	1.5%	1.1%	1.3%	7.5%	9.1%	7.1%	9.3%	7.7%	8.5%	7.3%	9.6%	7.2%	9.1%	1.2%	1.3%	1.1%	1.5%	1.1%	1.4%
HVAC Pump Motor (unknown use)	C38	3.4%	4.1%	3.1%	3.9%	3.3%	4.6%	3.3%	4.0%	4.4%	5.2%	4.1%	5.4%	4.5%	4.9%	4.3%	5.5%	4.2%	5.2%	3.5%	4.0%	3.2%	4.4%	3.4%	4.2%
VFD - Supply fans <10 HP	C39	5.7%	2.3%	5.2%	2.1%	5.5%	2.5%	5.6%	2.2%	5.8%	3.3%	5.5%	3.4%	5.9%	3.1%	5.7%	3.5%	5.5%	3.3%	5.8%	2.2%	5.4%	2.4%	5.7%	2.3%
VFD - Return fans <10 HP	C40	5.7%	2.3%	5.2%	2.1%	5.5%	2.5%	5.6%	2.2%	5.8%	3.3%	5.5%	3.4%	5.9%	3.1%	5.7%	3.5%	5.5%	3.3%	5.8%	2.2%	5.4%	2.4%	5.7%	2.3%
VFD - Exhaust fans <10 HP	C41	5.1%	3.3%	4.6%	3.1%	4.9%	3.7%	5.0%	3.2%	4.1%	4.3%	3.9%	4.4%	4.2%	4.1%	4.1%	4.6%	4.0%	4.3%	5.2%	3.2%	4.8%	3.5%	5.1%	3.4%
VFD - Boiler feedwater pumps <10 HP	C42	6.4%	6.2%	5.7%	5.9%	6.1%	7.0%	6.1%	6.0%	1.3%	1.3%	1.3%	1.3%	1.4%	1.2%	1.3%	1.3%	1.3%	1.3%	6.4%	6.0%	5.9%	6.6%	6.3%	6.4%
VFD - Chilled water pumps <10 HP	C43	1.7%	0.8%	1.5%	0.7%	1.6%	0.9%	1.6%	0.8%	8.3%	8.5%	7.8%	8.7%	8.5%	8.0%	8.1%	8.9%	7.9%	8.5%	1.7%	0.8%	1.6%	0.8%	1.6%	0.8%
VFD Boiler circulation pumps <10 HP	C44	6.4%	6.2%	5.7%	5.9%	6.1%	7.0%	6.1%	6.0%	1.3%	1.3%	1.3%	1.3%	1.4%	1.2%	1.3%	1.3%	1.3%	1.3%	6.4%	6.0%	5.9%	6.6%	6.3%	6.4%
Refrigeration Economizer	C45	5.4%	7.2%	4.8%	6.7%	5.1%	8.0%	5.2%	7.0%	1.1%	1.5%	1.1%	1.5%	1.2%	1.4%	1.1%	1.5%	1.1%	1.5%	5.4%	7.0%	5.0%	7.6%	5.3%	7.4%
Evaporator Fan Control	C46	3.6%	5.1%	3.2%	4.8%	3.4%	5.7%	3.4%	4.9%	3.4%	4.7%	3.2%	4.8%	3.5%	4.4%	3.3%	4.9%	3.3%	4.7%	3.6%	4.9%	3.3%	5.4%	3.5%	5.2%
Standby Losses - Commercial Office	C47	1.2%	7.1%	1.1%	6.7%	1.2%	8.0%	1.2%	6.9%	1.1%	7.1%	1.1%	7.3%	1.2%	6.7%	1.1%	7.5%	1.1%	7.1%	1.2%	6.9%	1.1%	7.5%	1.2%	7.3%
VFD Boiler draft fans <10 HP	C48	5.5%	6.9%	5.0%	6.5%	5.3%	7.7%	5.3%	6.7%	1.3%	1.5%	1.2%	1.5%	1.3%	1.4%	1.3%	1.5%	1.2%	1.5%	5.6%	6.7%	5.2%	7.3%	5.5%	7.1%
VFD Cooling Tower Fans	C49	1.2%	0.7%	1.1%	0.7%	1.1%	0.8%	1.1%	0.7%	11.0%	6.5%	10.4%	6.7%	11.3%	6.2%	10.8%	6.9%	10.5%	6.5%	1.2%	0.7%	1.1%	0.8%	1.2%	0.8%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
<10 HP																									
Engine Block Heater Timer	C50	3.9%	8.6%	3.5%	8.1%	3.7%	9.6%	3.8%	8.3%	0.8%	1.7%	0.8%	1.7%	0.8%	1.6%	0.8%	1.8%	0.8%	1.7%	4.0%	8.3%	3.7%	9.1%	3.9%	8.9%
Door Heater Control	C51	4.5%	9.8%	4.0%	9.2%	4.3%	11.0%	4.3%	9.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	9.5%	4.2%	10.4%	4.4%	10.1%
Beverage and Snack Machine Controls	C52	1.5%	6.8%	1.3%	6.4%	1.4%	7.6%	1.4%	6.6%	1.5%	6.8%	1.4%	7.0%	1.5%	6.4%	1.5%	7.2%	1.4%	6.8%	1.5%	6.6%	1.4%	7.2%	1.5%	7.0%
Flat	C53	5.4%	3.1%	4.8%	2.9%	5.1%	3.4%	5.2%	3.0%	5.3%	3.1%	5.0%	3.2%	5.5%	2.9%	5.2%	3.3%	5.1%	3.1%	5.4%	3.0%	5.0%	3.3%	5.3%	3.2%
Religious Indoor Lighting	C54	4.0%	4.4%	3.6%	4.2%	3.8%	5.0%	3.8%	4.3%	3.9%	4.5%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.5%	4.0%	4.3%	3.7%	4.7%	3.9%	4.6%
Commercial Clothes Washer	C55	7.0%	1.6%	6.3%	1.5%	6.6%	1.7%	6.7%	1.5%	6.9%	1.6%	6.5%	1.6%	7.1%	1.5%	6.8%	1.7%	6.6%	1.6%	7.0%	1.5%	6.5%	1.7%	6.9%	1.6%
Dairy Farm Combined End Uses	C56	5.1%	3.4%	4.6%	3.2%	4.8%	3.8%	4.9%	3.3%	5.1%	3.4%	4.8%	3.5%	5.2%	3.2%	5.0%	3.6%	4.9%	3.4%	5.1%	3.3%	4.7%	3.6%	5.0%	3.5%
Milk Pump	C57	4.4%	4.1%	3.9%	3.8%	4.2%	4.6%	4.2%	4.0%	4.3%	4.0%	4.1%	4.2%	4.4%	3.8%	4.3%	4.3%	4.2%	4.0%	4.4%	4.0%	4.1%	4.3%	4.3%	4.2%
Farm Plate Cooler / Heat Recovery Unit	C58	3.4%	2.4%	3.0%	2.2%	3.2%	2.6%	3.3%	2.3%	6.6%	5.6%	6.2%	5.7%	6.8%	5.3%	6.5%	5.9%	6.3%	5.6%	3.4%	2.3%	3.2%	2.5%	3.3%	2.4%

3.7 Summer Peak Period Definition (kW)

To estimate the impact that an efficiency measure has on a utility's system peak, the peak itself needs to be defined. Illinois spans two different electrical control areas, the Pennsylvania – Jersey – Maryland (PJM) and the Midwest Independent System Operators (MISO). As a result, there is some disparity in the peak definition across the state. However, only PJM has a forward capacity market where an efficiency program can potentially participate. Because ComEd is part of the PJM control area, their definition of summer peak is being applied statewide in this TRM.

Because Illinois is a summer peaking state, only the summer peak period is defined for the purpose of this TRM. The coincident summer peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.

Summer peak coincidence factors can be found within each measure characterization. The source is provided and is based upon evaluation results, analysis of load shape data (e.g., the Itron eShapes data provided by Ameren), or through a calculation using stated assumptions.

For measures that are not weather-sensitive, the summer peak coincidence factor is estimated whenever possible as the average of savings within the peak period defined above. For weather sensitive measures such as cooling, the summer peak coincidence factor is provided in two different ways. The first method is to estimate demand savings during the utility's peak hour (as provided by Ameren). This is likely to be the most indicative of actual peak benefits. The second way represents the average savings over the summer peak period, consistent with the non-weather sensitive end uses, and is presented so that savings can be bid into PJM's Forward Capacity Market.

3.8 Heating and Cooling Degree-Day Data

Many measures are weather sensitive. Because there is a range of climactic conditions across the state, VEIC engaged the Utilities to provide their preferences for what airports and cities are the best proxies for the weather in their service territories. The result of this engagement is in the table below. All of the data represents 30-year normals³³ from the National Climatic Data Center (NCDC). Note that the base temperature for the calculation of heating degree-days in this document does not follow the historical 65F degree base temperature convention. Instead VEIC used several different temperatures in this TRM to more accurately reflect the outdoor temperature when a heating or cooling system turns on.

Residential heating is based on 60F, in accordance with regression analysis of heating fuel use and weather by state by the Pacific Northwest National Laboratory³⁴. Residential cooling is based on 65F in agreement with a field study in Wisconsin³⁵. These are lower than typical thermostat set points because internal gains, such as appliances, lighting, and people, provide some heating. In C&I settings, internal gains are often much higher; the base temperatures for both heating and cooling is 55F³⁶. Custom degree-days with building-specific base temperatures are recommended for large C&I projects.

Table 3.5: Degree-Day Zones and Values by Market Sector

Zone	Residential		C&I		Weather Station / City
	HDD	CDD	HDD	CDD	
1	5,352	820	4,272	2,173	Rockford AP / Rockford
2	5,113	842	4,029	3,357	Chicago O'Hare AP / Chicago
3	4,379	1,108	3,406	2,666	Springfield #2 / Springfield

³³ 30-year normals have been used instead of Typical Meteorological Year (TMY) data due to the fact that few of the measures in the TRM are significantly affected by solar insolation, which is one of the primary benefits of using the TMY approach.

³⁴ Belzer and Cort, Pacific Northwest National Laboratory in "Statistical Analysis of Historical State-Level Residential Energy Consumption Trends," 2004.

³⁵ Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research", p. 32 (amended in 2010).

³⁶ This value is based upon experience, and it is preferable to use building-specific base temperatures when available.

Zone	Residential		C&I		Weather Station / City
	HDD	CDD	HDD	CDD	
4	3,378	1,570	2,515	3,090	Belleville SIU RSCH / Belleville
5	3,438	1,370	2,546	2,182	Carbondale Southern IL AP / Marion
Average	4,860	947	3,812	3,051	Weighted by occupied housing units
Base Temp	60F	65F	55F	55F	30 year climate normals, 1981-2010

This table assigns each of the proxy cities to one of five climate zones. The following graphics from the Illinois State Water Survey show isobars (lines of equal degree-days), and we have color-coded the counties in each of these graphics using those isobars as a dividing line. Using this approach, the state divides into five cooling degree-day zones and five heating degree-day zones. Note that although the heating and cooling degree-day maps are similar, they are not the same, and the result is that there are a total of 10 climate zones in the state. The counties are listed in the tables following the figures for ease of reference. In addition, an Excel file containing all Illinois Zip Codes with the corresponding Heating and Cooling Degree-day zones is provided on the SharePoint site within the 'TRM Reference Documents' section.

Figure 3.1: Cooling Degree-Day Zones by County

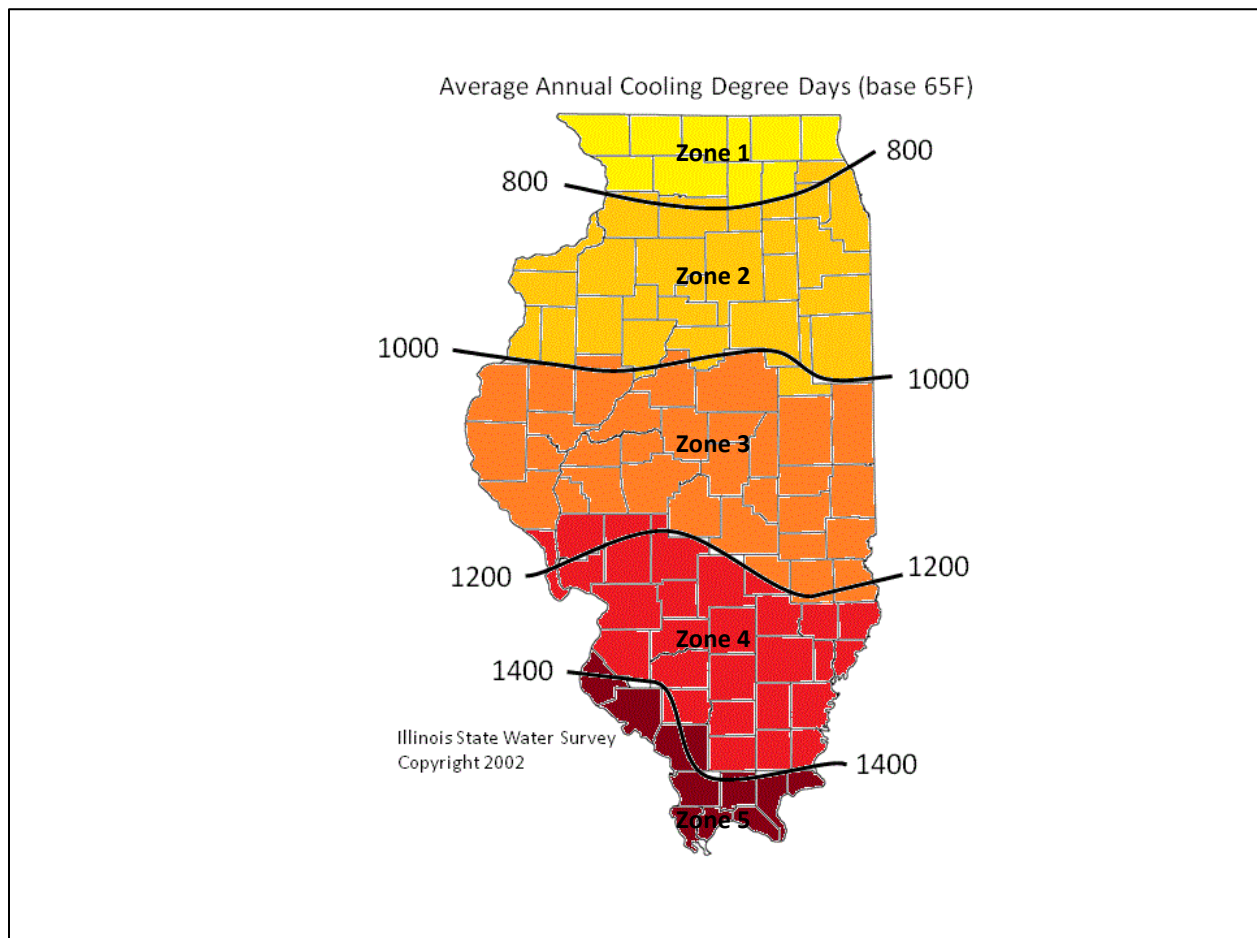
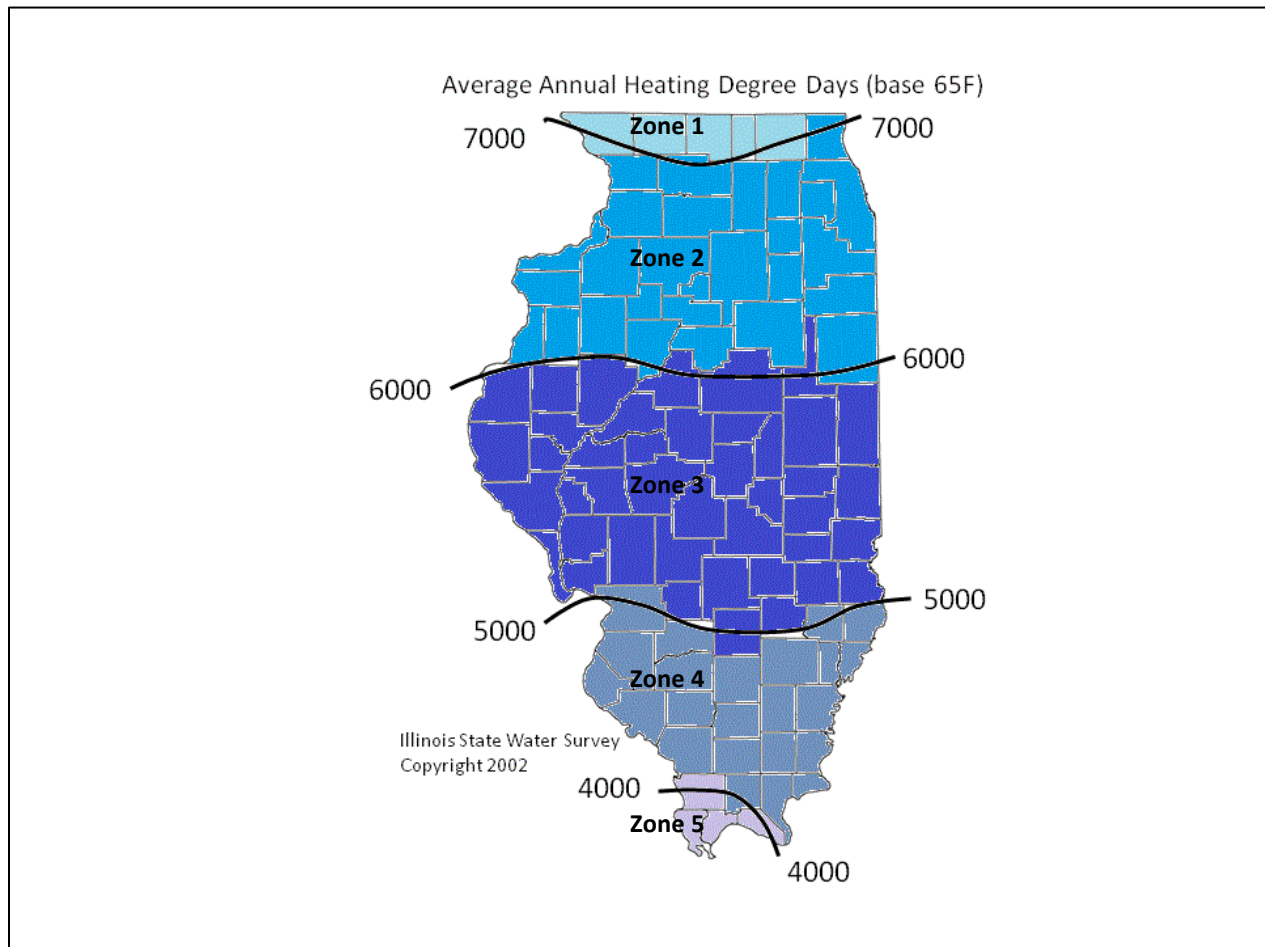


Figure 3.2: Heating Degree-Day Zones by County

Table 3.6: Heating Degree-Day Zones by County

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Boone County	Bureau County	Adams County	Clinton County	Alexander County
Jo Daviess County	Carroll County	Bond County	Edwards County	Massac County
Stephenson County	Cook County	Brown County	Franklin County	Pulaski County
Winnebago County	DeKalb County	Calhoun County	Gallatin County	Union County
	DuPage County	Cass County	Hamilton County	
	Grundy County	Champaign County	Hardin County	
	Henderson County	Christian County	Jackson County	
	Henry County	Clark County	Jefferson County	
	Iroquois County	Clay County	Johnson County	
	Kane County	Coles County	Lawrence County	
	Kankakee County	Crawford County	Madison County	
	Kendall County	Cumberland County	Marion County	
	Knox County	De Witt County	Monroe County	
	Lake County	Douglas County	Perry County	
	LaSalle County	Edgar County	Pope County	
	Lee County	Effingham County	Randolph County	
	Livingston County	Fayette County	Richland County	
	Marshall County	Ford County	Saline County	

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
	McHenry County	Fulton County	St. Clair County	
	Mercer County	Greene County	Wabash County	
	Ogle County	Hancock County	Washington County	
	Peoria County	Jasper County	Wayne County	
	Putnam County	Jersey County	White County	
	Rock Island County	Logan County	Williamson County	
	Stark County	Macon County		
	Warren County	Macoupin County		
	Whiteside County	Mason County		
	Will County	McDonough County		
	Woodford County	McLean County		
		Menard County		
		Montgomery		
		Morgan County		
		Moultrie County		
		Piatt County		
		Pike County		
		Sangamon County		
		Schuyler County		
		Scott County		
		Shelby County		
		Tazewell County		
		Vermilion County		

Table 3.7: Cooling Degree-day Zones by County

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Boone County	Bureau County	Adams County	Bond County	Alexander County
Carroll County	Cook County	Brown County	Clay County	Hardin County
DeKalb County	DuPage County	Calhoun County	Clinton County	Johnson County
Jo Daviess County	Grundy County	Cass County	Edwards County	Massac County
Kane County	Henderson County	Champaign County	Fayette County	Pope County
Lake County	Henry County	Christian County	Franklin County	Pulaski County
McHenry County	Iroquois County	Clark County	Gallatin County	Randolph County
Ogle County	Kankakee County	Coles County	Hamilton County	Union County
Stephenson County	Kendall County	Crawford County	Jackson County	
Winnebago County	Knox County	Cumberland County	Jefferson County	
	LaSalle County	De Witt County	Jersey County	
	Lee County	Douglas County	Lawrence County	
	Livingston County	Edgar County	Macoupin County	
	Marshall County	Effingham County	Madison County	
	Mercer County	Ford County	Marion County	
	Peoria County	Fulton County	Monroe County	
	Putnam County	Greene County	Montgomery	
	Rock Island County	Hancock County	Perry County	
	Stark County	Jasper County	Richland County	
	Warren County	Logan County	Saline County	
	Whiteside County	Macon County	St. Clair County	
	Will County	Mason County	Wabash County	

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
	Woodford County	McDonough County	Washington County	
		McLean County	Wayne County	
		Menard County	White County	
		Morgan County	Williamson County	
		Moultrie County		
		Piatt County		
		Pike County		
		Sangamon County		
		Schuyler County		
		Scott County		
		Shelby County		
		Tazewell County		
		Vermilion County		

3.9 Measure Incremental Cost Definition

Operations and Maintenance (O&M) and/or Deferred Baseline Replacement Cost Changes: Any avoided costs are treated as benefits and any increased costs are treated as Incremental Costs. In cases where the efficient Measure has a significantly shorter or longer life than the relevant baseline measure (e.g., LEDs versus halogens), the avoided baseline replacement measure costs should be accounted for as a benefit in the TRC test analysis.

Incremental Costs means the difference between the cost of the efficient Measure and the cost of the most relevant baseline measure that would have been installed (if any) in the absence of the efficiency Program. Installation costs (material and labor) shall be included if there is a difference between the efficient Measure and the baseline measure. The Customer's value of service lost, the Customer's value of their lost amenity, and the Customer's transaction costs shall be included in the TRC test analysis where a reasonable estimate or proxy of such costs can be easily obtained (e.g., Program Administrator payment to a Customer to reduce load during a demand response event, Program Administrator payment to a Customer as an inducement to give up functioning equipment). This Incremental Cost input in the TRC analysis is not reduced by the amount of any Incentives (any Financial Incentives Paid to Customers or Incentives Paid to Third Parties by a Program Administrator that is intended to reduce the price of the efficient Measure to the Customer). Incremental Cost calculations will vary depending on the type of efficient Measure being implemented, as outlined in the examples provided below and as set forth in the IL-TRM. Note that the TRM includes at least one deemed incremental cost(s) as a default value(s) for most measures. However, consistent with the TRM Policy Document policy, in instances where Program Administrators have better information on the true incremental cost of the measures (e.g., direct install programs), the Program Administrator-specific incremental cost value should be used for the purposes of cost-effectiveness analysis.

Examples of Incremental Cost calculations include:

- The Incremental Cost for an efficient Measure that is installed in new construction or is being purchased at the time of natural installation, investment, or replacement is the additional cost incurred to purchase an efficient Measure over and above the cost of the baseline/standard (i.e., less efficient) measure (including any incremental installation, replacement, or O&M costs if those differ between the efficient Measure and baseline measure).
- For a retrofit Measure where the efficiency Program caused the Customer to update their existing equipment, facility, or processes (e.g., air sealing, insulation, tank wrap, controls), where the Customer would not have otherwise made a purchase, the appropriate baseline is zero expenditure, and the Incremental Cost is the full cost of the new retrofit Measure (including installation costs).
- For the early replacement of functioning equipment with a new efficient Measure, where the Customer would not have otherwise made a purchase for a number of years, the appropriate baseline is a dual baseline that begins as the existing equipment and shifts to the new standard equipment after the expected remaining useful life of the existing equipment ends. Thus, the Incremental Cost is the full cost of the new

efficient Measure (including installation costs) being purchased to replace a still-functioning equipment less the present value of the assumed deferred replacement cost (including installation costs) of replacing the existing equipment with a new baseline measure at the end of the existing equipment's life. This deferred credit may not be necessary when the lifetime of the measure is short, the costs are very low, the measure is highly cost-effective even without the deferred credit, or for other reasons (e.g., certain Direct Install Measures, Measures provided in Kits to Customers).³⁷

- d. For study-based services (e.g., facility energy audits, energy surveys, energy assessments, retro-commissioning, new construction design services), the Incremental Cost is the full cost of the study-based service. Even if the study-based service is performed entirely by a Program Administrator's program implementation contractor, the full cost of the study-based service charged by the program implementation contractor is the Incremental Cost, because this is assumed to be the cost of the study-based service that would have been incurred by the Customer if the Customer were to have the study-based service performed in the absence of the efficiency Program. If the Customer implements efficient Measures as a result of the study-based service provided by the efficiency Program, the Incremental Cost for those efficient Measures should also be classified as Incremental Costs in the TRC analysis. Note that the Incremental Costs associated with study-based services should be included in Cost-Effectiveness calculations "only at the level at which they become variable."³⁸ In some cases, this will be at the Measure level; in others, it will be at the Program level. Such costs should be included in Measure-level Cost-Effectiveness calculations only when they are inseparable from the efficiency improvements – i.e., when the provision of the study-based service is what produces energy savings (e.g., retro-commissioning). Conversely, when study-based service costs are separable from the costs of the efficient Measures themselves and Customer, Program Administrator and/or other parties have discretion over which of the identified efficient Measures to subsequently install (e.g., for facility energy audits, surveys or assessments that are used to identify potential efficient Measures for installation), the Incremental Cost associated with such study-based services should be included only in Program-level Cost-Effectiveness analyses (rather than allocated to individual efficient Measures).
- e. For the early retirement of functioning equipment before its expected life is over (e.g., appliance recycling Programs), the Incremental Costs are composed of the Customer's value placed on their lost amenity, any Customer transaction costs, and the pickup and recycling cost. The Incremental Costs include the actual cost of the pickup and recycling of the equipment (often paid for by a Program Administrator to a program implementation contractor) because this is assumed to be the cost of recycling the equipment that would have been incurred by the Customer if the Customer were to recycle the equipment on their own in the absence of the efficiency Program. The payment a Program Administrator makes to the Customer serves as a proxy for the value the Customer places on their lost amenity and any Customer transaction costs.

3.10 Discount Rates, Inflation Rates, and O&M Costs

The Illinois Utilities use screening tools that apply an appropriate discount rate to any future costs or benefits. The societal discount rate, required for use by all electric utilities, is defined as a nominal discount rate of 2.38%, or a real (inflation-adjusted) discount rate of 0.46%³⁹.

Where a future cost is provided within the TRM (e.g., in early replacement measures where a deferred baseline replacement cost is provided) and the future cost has been adjusted using an inflation rate (based upon the 20-year Treasury yield of 1.91%⁴⁰), the nominal discount rate should be used to discount to the present value. Where future

³⁷ In such instances, the Incremental Cost is the full cost of direct installation Measures (materials and labor) and the full cost of Measures provided in Kits to Customers.

³⁸ See The National Efficiency Screening Project, National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, Edition 1, Spring 2017. Retrieved from <https://nationalefficiencyscreening.org/national-standard-practice-manual/>.

³⁹ Based on the current 10 year Treasury bond yield rates, as of January 2017. The 10 year rates are used to be consistent with the average measure life of the measures specified within this TRM.

⁴⁰ Established for use in the TRM in late 2015.

costs have not been adjusted for inflation, the real discount rate should be used to discount to present value.

The following table provides the historical discount rate that have been applied:

TRM Versions	Nominal Discount Rate	Real Discount Rate	Inflation Rate
V6.0 to V8.0	2.38%	0.46% (10yr Treasury bond rates)	1.91%
V5.0	Not specified	5.34% (WACC)	1.91%
Up to and including V4.0	Not specified	5.23% (WACC)	Not specified

Some measures specify an operations and maintenance (O&M) parameter that describes the incremental O&M cost savings that can be expected over the measure's lifetime. For most measures the TRM does not specify the NPV of the O&M costs. Instead, the necessary information required to calculate the NPV is included. An example is provided below:

Baseline Case:	O&M costs equal \$150 every two years.
Efficient Case:	O&M costs equal \$50 every five years.

Given this information, the incremental O&M costs can be determined by discounting the cash flows in the Baseline Case and the Efficient Case separately using the real discount rate.

For a select few measures that include baseline shifts that result in multiple component costs and lifetimes over the lifetime of the measure, this standard method cannot be used. In only these cases, the O&M costs are presented both as Annual Levelized equivalent cost (i.e., the annual payment that results in an equivalent NPV to the actual stream of O&M costs) and as NPVs using a real societal discount rate of 0.46%.

When discounting nominal data that was adjusted to nominal from original real data using an inflation rate that is different than the IL-TRM inflation rate value, the analyst should first adjust for inflation using the original (non-IL-TRM) value to convert the data back to the appropriate year's real dollars and then use the real discount rate as specified in the IL-TRM.

3.11 Interactive Effects

The TRM presents engineering equations for most measures. This approach is desirable because it conveys information clearly and transparently, and is widely accepted in the industry. Unlike simulation model results, engineering equations also provide flexibility and the opportunity for users to substitute local, specific information for specific input values. Furthermore, the parameters can be changed in TRM updates to be applied in future years as better information becomes available.

One limitation is that some interactive effects between measures are not automatically captured. Because we cannot know what measures will be implemented at the same time with the same customer, we cannot always capture the interactions between multiple measures within individual measure characterizations. However, interactive effects with different end-uses are included in individual measure characterizations whenever possible⁴¹. For instance, waste heat factors are included in the lighting characterizations to capture the interaction between more-efficient lighting measures and the amount of heating and/or cooling that is subsequently needed in the building.

By contrast, no effort is made to account for interactive effects between an efficient air conditioning measure and an efficient lighting measure, because it is impossible to know the specifics of the other measure in advance of its

⁴¹ For more information, please refer to the document, "Dealing with interactive Effects During Measure Characterization" Memo to the Stakeholder Advisory Group dated 12/13/11.
http://portal.veic.org/projects/illinoistrm/Shared%20Documents/Memos/Interactive_Effects_Memo_121311.docx

installation. For custom measures and projects where a bundle of measures is being implemented at the same time, these kinds of interactive effects should be estimated.